SOIL SURVEY

Rogers County, Oklahoma

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

Issued August 1966

Major fieldwork for this soil survey was done in the period 1957–61. Soil names and descriptions were approved in 1963. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1961. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station; it is part of the technical assistance furnished to the Rogers County Soil Conservation District.

HOW TO USE THIS SOIL SURVEY REPORT

THIS SOIL SURVEY of Rogers County, Oklahoma, will serve several groups of readers. It will help farmers and ranchers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid managers of forests and woodland; and add to soil scientists' knowledge of soils.

Locating the Soils

At the back of this report is an index map and a soil map consisting of many sheets. The index map is numbered to correspond to the sheets of the soil map so that the sheet showing any area can be located easily. On each map sheet, the soil boundaries are outlined and there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil.

Finding Information

In the "Guide to Mapping Units" at the back of this report, each soil is listed according to the alphabetic order of its map symbol. This guide gives the page where each soil is described; it shows, also, the capability unit and the range site in which the soil has been placed, and the pages where these are described.

Farmers and those who work with farmers can learn about the soils on a farm by reading the description of each soil and of the capability unit and other groupings in which it has been placed. A convenient way of doing this is to turn to the soil map and list the symbols for the soils on the farm and then to use the "Guide to Mapping Units" in finding the pages where each soil and its groupings are described.

Foresters and others interested in woodland can refer to the subsection "Woodland Management." In that subsection the soils in the county are placed in groups according to their suitability for trees, and the management of each group is discussed.

Game managers, sportsmen, and others concerned with wildlife will find information about the main kinds of wildlife and their food and cover in the subsection "Wildlife."

Ranchers and others interested in range will want to refer to the subsection "Use of Soils for Range."

Engineers and builders will find in the subsection "Engineering Uses of the Soils" tables that give engineering descriptions of the soils in the county and that name soil features affecting engineering practices and structures.

Scientists and others who are interested can read about how the soils were formed and how they were classified in the section "Formation, Classification, and Morphology of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in Rogers County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

Cover picture: **Raising beef cattle is the most important agricultural enterprise in Rogers County.**

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NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on next page.

Issued August 1966

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas-Eldorado Area, Nev.
Series 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF ROGERS COUNTY, OKLAHOMA

BY DOCK J. POLONE, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH OKLAHOMA AGRICULTURAL EXPERIMENT STATION

ROGERS COUNTY is in the northeastern part of Oklahoma (fig. 1). It has an area of approximately 456,320 acres, or 713 square miles. Claremore, the county seat, is near the center of the county, and according to the 1960 census, has a population of 6,639. The elevation of the county ranges from 600 to 750 feet. At the Will Rogers Airport at Claremore the elevation is 649 feet.

In this county the principal income is from the sale of agricultural products. Livestock raising is the major type of farming, and most of the land is used for pasture or for the production of feed. Hay and corn are the main feed crops. Other crops used for feed or sold as cash crops are small grain, alfalfa, sorghum, and soybeans.

How the Soil Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Rogers County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that had not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

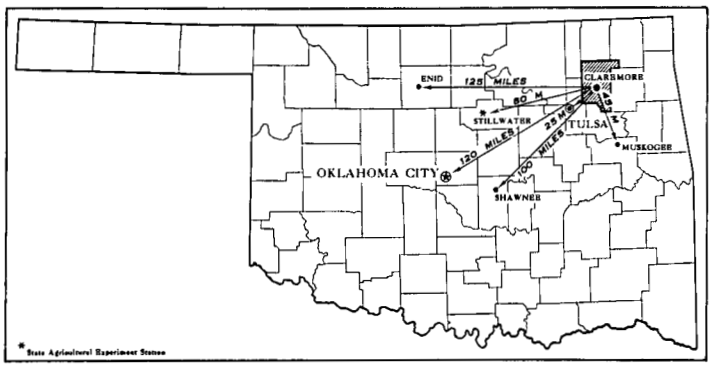

Figure 1.—**Location of Rogers County in Oklahoma.**

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Dennis and Summit, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural landscape. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Verdigris silt loam and Verdigris clay loam are two soil types in the Verdigris series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Dennis silt loam, 1 to 3 percent slopes, is one of two phases of Dennis silt loam, a soil type that ranges from nearly level to gently sloping.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing soil boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other

kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soils in it, for example, Dennis-Bates complex. The soil scientist may also show as one mapping unit two or more soils that do not occur in regular geographic association. Such a mapping unit is called an undifferentiated group, for example, Bates and Dennis soils, 3 to 5 percent slopes, eroded. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked in construction, or in mining, that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Borrow pits, Gravel pits, or Strip mines, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. The soil scientists set up trial groups, based on the yield and practice tables and other data, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Rogers County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils of a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The five soil associations in Rogers County are discussed in the following pages. Three of these associations are mainly upland prairies, one is bottom lands along streams, and the fifth is in scattered upland areas mainly in trees and pasture.

1. Dennis-Choteau association: Nearly level and moderately sloping soils formed under prairie grasses, on the uplands

This soil association occupies mainly the nearly level to gently sloping valleys, but it includes a few ridges and breaks where the soils are shallow to very shallow. The soils formed in sandstone and shale, under tall native grasses. Except on the ridges and breaks, the soils are deep and productive of pasture, range, and most cultivated crops adapted to the county. This association occupies about 48 percent of the county.

The major soils, the Dennis and Choteau, make up about 40 percent of this association. They are deep, dark-colored, loamy soils on the prairies (fig. 2). They are nearly level to moderately sloping and are moderately well drained or well drained.

Minor soils in the association that are similar to the major soils are the Bates, Riverton, and Okemah. Other minor soils are the Taloka, Parsons, Woodson, and Dwight, which are claypan soils and which are slowly permeable and somewhat poorly drained. Some areas of Collinsville soils are on ridges and breaks in this association; these soils are used mainly for range.

The main problems in cultivated areas of this association are water erosion and the maintenance of fertility. Pasture and range plants respond to good management.

2. Collinsville-Bates association: Gently sloping to steep, loamy soils formed under prairie grasses, on sandstone uplands

This soil association occurs in the northwest corner of the county and on the eastern side southeast of Claremore. It makes up about 10 percent of the county. The soils are mainly shallow and have formed under tall native grasses from sandstone and shale. They are generally in rolling to hilly areas of prairie and are used principally for range. Pasture and range plants on these soils respond to good management.

The Collinsville soils make up nearly 70 percent of the association. They are very shallow, dark-colored, loamy soils that are stony, moderately sloping or steep, and somewhat excessively drained. These soils are used mainly for range.

The Bates soils make up nearly 30 percent of the association. They are shallow, dark-colored, loamy soils that are gently or moderately sloping and are well drained (see fig. 2). They are used mainly for range.

Minor soils in this association are the Dennis and Okemah, which are similar to the Bates soils.

3. Newtonia-Sogn-Summit association: Gently sloping to strongly sloping, loamy soils formed under prairie grasses, on limestone uplands

This soil association occurs in a broad band that crosses the county in a southwest-northeast direction along the Verdigris River. It occupies about 21 percent of the county. The soils of this association developed under tall native grasses from limestone and calcareous shale (fig. 3).

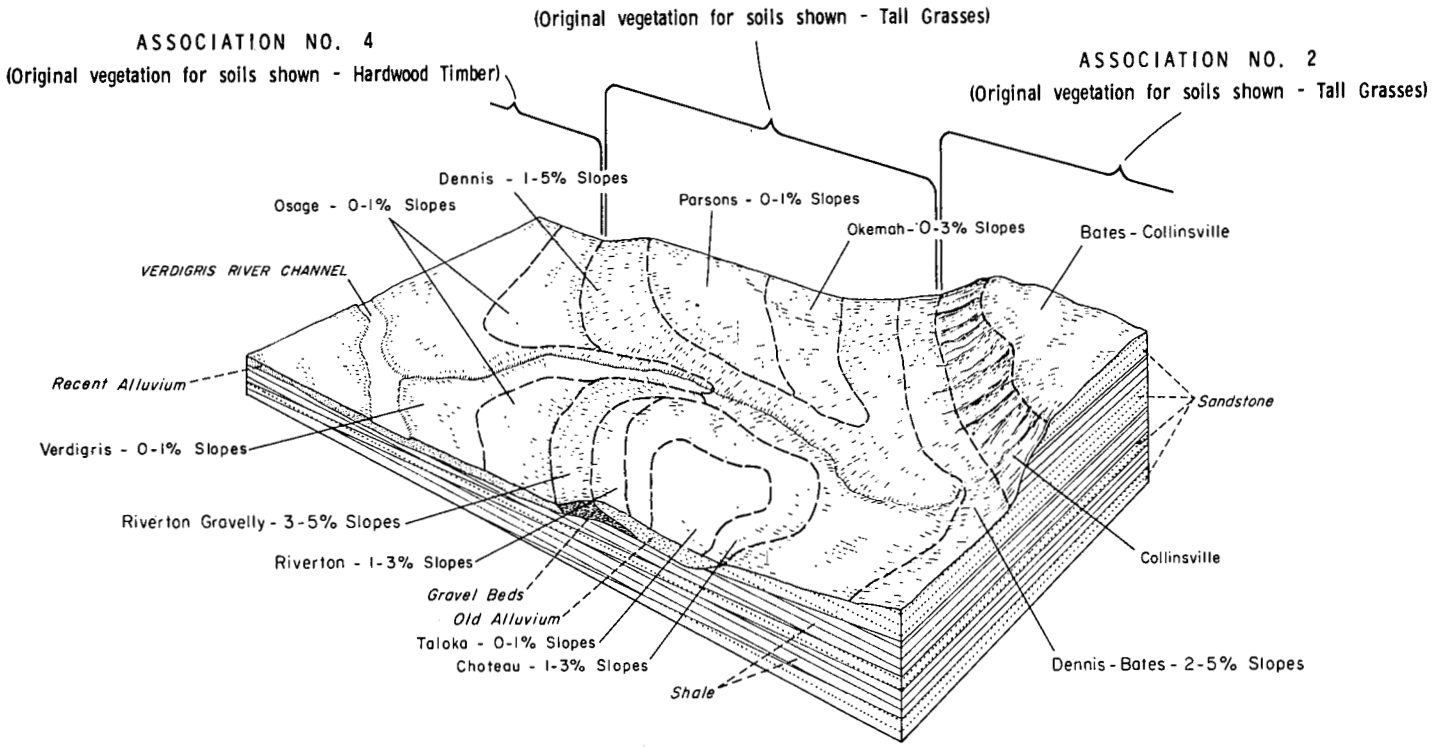

Figure 2.—General locations of soil associations 1, 2, and 4 in a landscape that is typical of the central and eastern parts of Rogers County.

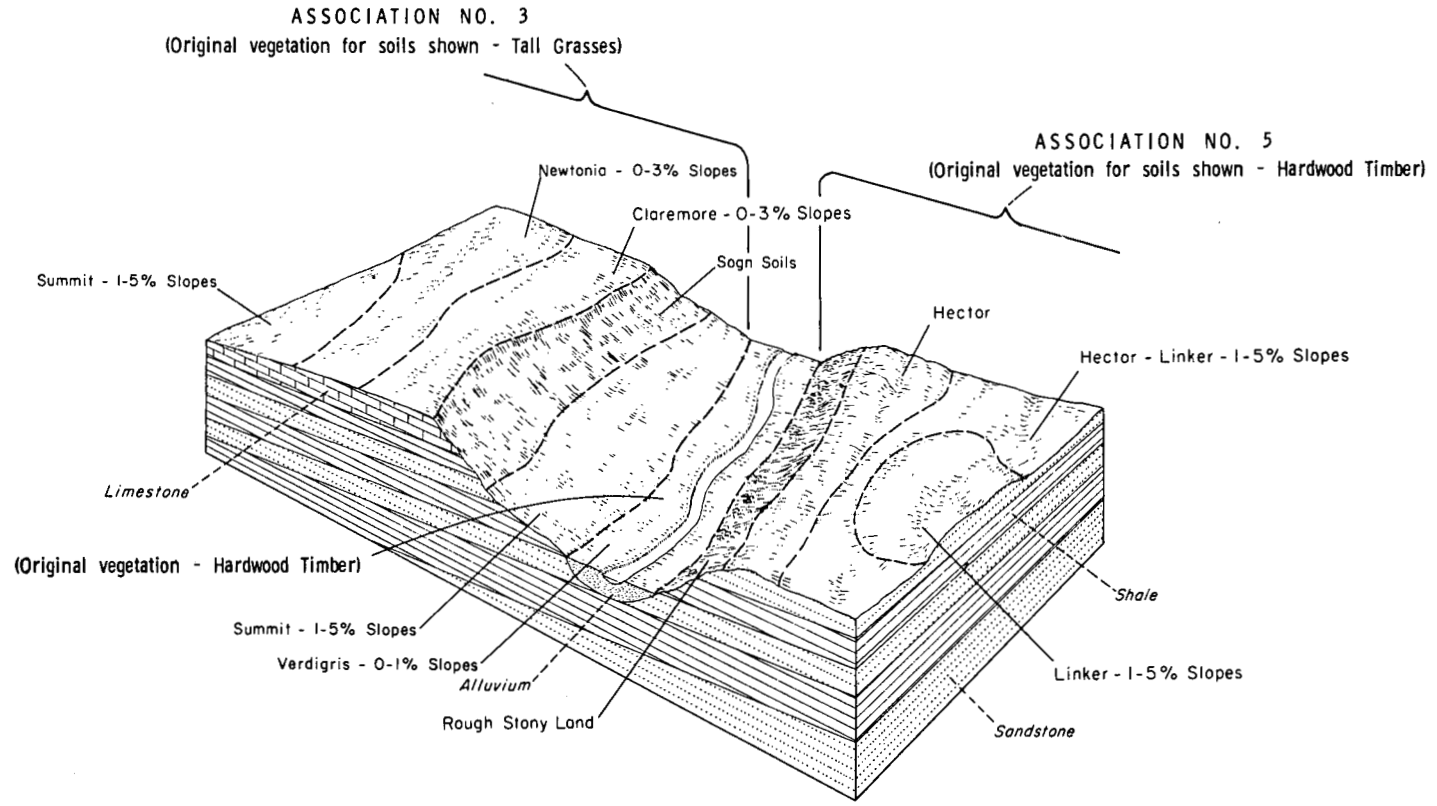

Figure 3.—General locations of soil associations 3 and 5 in a landscape that is typical of the central and eastern parts of Rogers County.

The Newtonia soils make up about 30 percent of the association. They are reddish, gently or moderately sloping loamy soils that are well drained. They are used mainly for the production of small grain, sorghum, corn, soybeans, and tame pasture.

The Sogn soils, which make up about 28 percent of the association, are stony, very shallow, and loamy. They are gently sloping or moderately steep and are excessively drained. They are suited only for range.

The Summit soils make up about 23 percent of the association. These are deep, dark-colored, loamy soils that are gently or moderately sloping and moderately well drained. They are used mainly for the production of small grain, sorghum, corn, alfalfa, soybeans, and tame pasture.

The minor soils in this association are the Claremore, Woodson, Okemah, and Dennis. Their use is similar to that of the Newtonia and Summit soils.

The major problems in cultivated areas of this association are water erosion and fertility. Pasture and range plants on these soils respond to good management.

4. Verdigris-Osage association: Nearly level, deep, loamy and clayey soils on bottom lands

This soil association is along the Verdigris and Caney Rivers and the larger creeks. It makes up about 11 percent of the county. Nearly all of the soils are on level bottom lands and are subject to occasional floods. The native vegetation was hardwood trees and tall native grasses.

The Verdigris soils make up about 60 percent of the association (see fig. 2). They are deep, dark-colored, loamy soils that are level and moderately well drained. They are very productive and are used mainly for corn, alfalfa, small grain, soybeans, and tame pasture.

The Osage soils make up about 40 percent of the association. They are deep, dark-colored, clayey soils that are nearly level and poorly drained. They are used largely for woodland pasture and for pecans.

The major problems on the soils of this association are surface drainage, maintenance of soil structure, and control of brush.

5. Hector-Linker association: Gently sloping to very steep, well-drained, loamy soils formed under trees, on uplands

This soil association makes up about 10 percent of the county and is mainly in the northeastern part. The soils developed under scattered trees and tall native grasses from sandstone and shale.

The Hector soils are the most extensive in the association (see fig. 3). They are shallow, loamy, gently sloping to steep soils that are somewhat excessively drained. They are used mainly for woodland pasture and tame pasture.

The Linker soils are deep, loamy, gently to moderately sloping, and well drained. Most of this area has been cleared and used for corn, small grain, sorghum, cotton, and tame pasture.

Areas of Rough stony land occur to a minor extent in this association. These areas are made up mainly of Hector soils, which are very steep, contain many large boulders, and are of limited use.

The major problems in using the soils of this association are water erosion, maintenance of fertility, and control of brush. Pasture and range plants respond to good management.

Descriptions of the Soils

The soil series (groups of soils) and single soils (mapping units) of Rogers County are described in this section. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How the Soil Survey Was Made," a few of the mapping units are not members of a soil series. Borrow pits, Gravel pits, and Strip mines do not belong to a soil series but, nevertheless, are listed in alphabetic order along with the soil series.

A soil symbol in parentheses follows each mapping unit and identifies that unit on the detailed soil map. Listed at the end of the description of a mapping unit are the capability unit and range site in which that kind of soil has been placed. The pages on which the capability unit is described can be found by referring to the "Guide to Mapping Units, Capability Units, and Range Sites" at the back of this report.

More detailed information about the soils is given in the section "Formation, Classification, and Morphology of Soils." Many terms used in the soil descriptions and in other sections of the report are defined in the Glossary.

Bates Series

The Bates series consists of deep, dark-colored, well-drained soils in the uplands. These soils formed under tall prairie grasses in material that weathered from sandstone. The Bates soils are well distributed throughout the county.

The surface layer is grayish-brown or very dark grayish-brown, medium acid loam about 16 inches thick. It has moderate, medium, granular structure and is friable when moist. It is moderately permeable and easily worked.

The subsoil is about 14 inches thick. The upper part is brown to dark-brown, strongly acid heavy loam that has moderate, medium and coarse, granular structure. It is friable when moist and is moderately permeable. The lower part is yellowish-brown to dark yellowish-brown, strongly acid light clay loam with a few red mottles. It has moderate, fine, subangular blocky structure and contains a few fragments of sandstone.

The substratum is partly weathered sandstone and shale, 6 inches thick, that is underlain by sandstone bedrock at 44 inches.

These soils are naturally well drained, and their internal drainage is medium. Their capacity to hold water is moderate. These soils are susceptible to water erosion.

The Bates soils are closely associated with the Dennis and Collinsville soils. In this county they are mapped only in a complex with Collinsville and in an undifferentiated group with Dennis soils. The Bates soils are coarser textured and more permeable than Dennis soils. They are deeper than the Collinsville soils, and have more distinct horizons.

Bates-Collinsville complex (Bc).—The soils in this complex are gently sloping to strongly sloping and are on upland prairies. Slopes range from 3 to 7 percent. The

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Symbol	Soil	Acres [1]	Percent
Bc	Bates-Collinsville complex	41,980	9.2
BdC2	Bates and Dennis soils, 3 to 5 percent slopes, eroded	6,840	1.5
Bp	Borrow pits	910	.2
Br	Breaks-Alluvial land complex	26,010	5.7
ChB	Choteau silt loam, 1 to 3 percent slopes	11,860	2.6
CmB	Claremore silt loam, 0 to 3 percent slopes	19,620	4.3
Co	Collinsville stony loam	12,780	2.8
DbC	Dennis-Bates complex, 2 to 5 percent slopes	31,940	7.0
DnB	Dennis silt loam, 1 to 3 percent slopes	61,600	13.5
DnC	Dennis silt loam, 3 to 5 percent slopes	4,110	.9
DwA	Dwight silt loam, 0 to 1 percent slopes	460	.1
Er	Eroded loamy land	910	.2
Gp	Gravel pits	460	.1
Hc	Hector stony sandy loam	19,160	4.2
HlC	Hector-Linker fine sandy loams, 1 to 5 percent slopes	13,690	3.0
LkB	Linker fine sandy loam, 1 to 3 percent slopes	2,740	.6
LkC	Linker fine sandy loam, 3 to 5 percent slopes	910	.2
NaA	Newtonia silt loam, 0 to 1 percent slopes	460	.1
NaB	Newtonia silt loam, 1 to 3 percent slopes	25,550	5.6
OkA	Okemah silty clay loam, 0 to 1 percent slopes	3,650	.8
OkB	Okemah silty clay loam, 1 to 3 percent slopes	4,560	1.0
OkB2	Okemah silty clay loam, 1 to 3 percent slopes, eroded	460	.1
Os	Osage clay	19,170	4.2
PaA	Parsons silt loam, 0 to 1 percent slopes	12,780	2.8
RmB	Riverton loam, 1 to 3 percent slopes	1,370	.3
RvC	Riverton gravelly loam, 3 to 5 percent slopes	5,930	1.3
RvC2	Riverton gravelly loam, 3 to 5 percent slopes, eroded	460	.1
Rs	Rough stony land	9,130	2.0
Sm	Strip mines	5,930	1.3
So	Sogn soils	28,750	6.3
SuB	Summit silty clay loam, 1 to 3 percent slopes	8,670	1.9
SuC	Summit silty clay loam, 3 to 5 percent slopes	11,860	2.6
SuC2	Summit silty clay loam, 1 to 5 percent slopes, eroded	2,740	.6
TaA	Taloka silt loam, 0 to 1 percent slopes	9,130	2.0
Vd	Verdigris silt loam	5,480	1.2
Ve	Verdigris clay loam	18,710	4.1
Vf	Verdigris soils, frequently flooded	12,780	2.8
WsA	Woodson and Summit soils, 0 to 1 percent slopes	4,560	1.0
	Water areas	8,210	1.8
	Total	456,320	100.0

[1] Figures rounded to nearest 10 acres.

complex contains about 80 percent Bates and about 20 percent Collinsville soils. The Bates and Collinsville soils are described under their respective series. The Bates soils in this complex, however, differ from the soil described for the Bates series in having thinner layers. The Collinsville soils in this complex differ from the soil described for the Collinsville series in having thicker layers and fewer stones on the surface.

Included in mapping are some areas of Parsons silt loam and of Dennis silt loam.

This complex is used mainly for range or for pasture seeded to native grasses. Some fields are used for small grain, grain sorghum, and tame pasture. (Capability unit IVe–1; Loamy Prairie range site)

Bates and Dennis soils, 3 to 5 percent slopes, eroded (BdC2).—Because their differences are not significant to soil management, these soils were mapped as one unit. They are moderately sloping soils in the uplands. The Bates and Dennis soils are described under their respective series. The soils in this unit, however, differ from the normal Bates and Dennis soils in having a much thinner surface layer. Also, in some places the subsoil has been exposed by erosion, and there are a few gullies.

Included in mapping are a few areas of Linker fine sandy loam.

The major problems in using the soils in this unit are severe water erosion, low fertility, and poor soil structure. The soils are used mainly for tame pasture. (Capability unit IIIe–4; Loamy Prairie range site)

Borrow Pits (Bp)

Borrow pits are areas from which soil has been excavated. The soil material removed from these areas was used mainly for road construction or for fills. Borrow pits are of very limited use, other than for wildlife or as water areas. (Capability unit VIIIs–1; not assigned to a range site)

Breaks-Alluvial Land Complex (Br)

This complex of land types consists of channels of intermittent streams ranging from 10 to 30 feet in width, narrow valley floors ranging generally from 10 to 50 feet, and sloping to steep valley sides ranging from 50 to 150 feet. Soils similar to the Dennis, the shallow Bates, and the Collinsville soils make up about 80 percent of the complex; the Verdigris soils make up the rest.

This land is used mainly for native pasture. It is susceptible to very severe erosion. (Both land types, capability unit VIe–1; Breaks, Loamy Prairie range site; Alluvial land, Loamy Bottomland range site)

Choteau Series

In the Choteau series are deep, dark-colored, gently sloping soils of uplands. These soils likely formed under tall prairie grasses in old alluvium or valley fill.

The surface layer is strongly acid silt loam about 26 inches thick. To a depth of 16 inches, this layer is grayish brown or very dark grayish brown, and in the lower 10 inches it is pale brown or yellowish brown. This layer has medium granular structure. It is moderately permeable and is friable when moist.

The subsoil is heavy silt loam about 34 inches thick. In the upper 6 inches, this layer is very pale brown or yellowish brown faintly mottled with strong brown. It has fine,

granular structure and is very strongly acid. In the lower 28 inches, the subsoil is very pale brown or yellowish brown and has many mottles of red, yellow, and grayish brown. This part of the subsoil is medium acid and has fine subangular blocky structure.

The substratum is coarsely mottled clay loam alluvium about 30 inches thick. The upper part is medium acid.

The Choteau soils are moderately well drained. Their internal drainage is medium, and permeability is moderate. Their capacity to hold water is high. These soils are susceptible to water erosion.

The Choteau soils are associated with Riverton, Taloka, and Dennis soils. The Choteau soils are not so red throughout as the Riverton soils and do not have beds of gravel in the substratum. They do not have a dense claypan subsoil like that in Taloka soils. They differ from Dennis soils in having lighter colors in the lower part of their surface layer and in having much thicker surface and subsoil layers.

Choteau silt loam, 1 to 3 percent slopes (ChB).—This gently sloping soil is in upland prairies (fig. 4). Included in mapping are a few small areas of Taloka silt loam, Dennis silt loam, and Okemah silty clay loam.

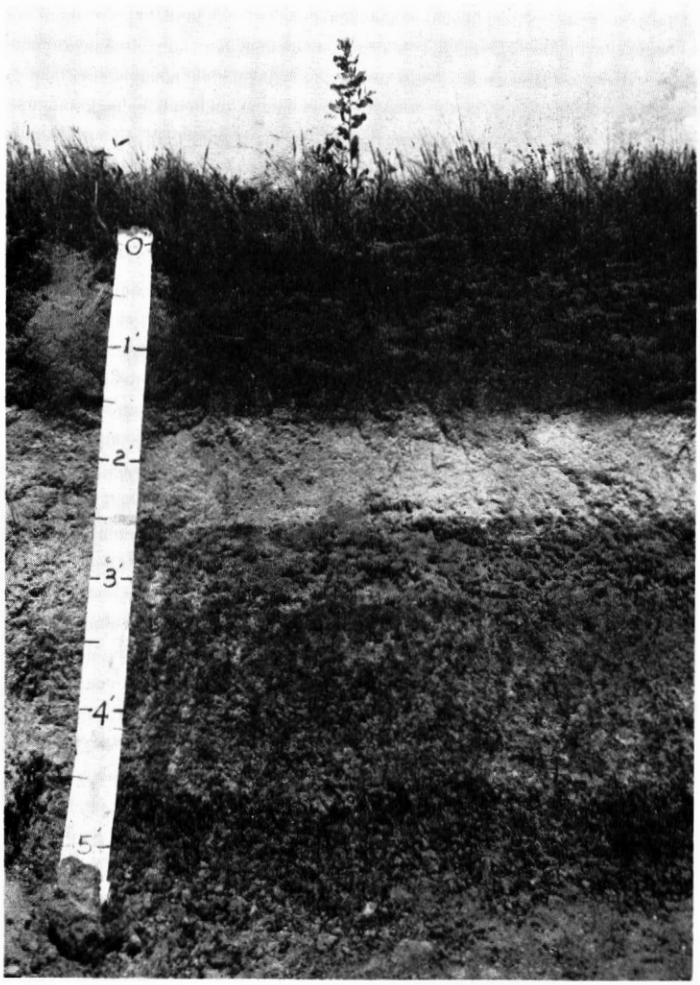

Figure 4.—Profile of Choteau silt loam in a field of tall native grasses.

A large acreage of this soil is cultivated. It is suited to small grain, grain sorghum, corn, soybeans, and tame grasses. (Capability unit IIe–2; Loamy Prairie range site)

Claremore Series

The Claremore series consists of moderately deep, reddish-brown, well-drained soils in the uplands. These soils formed under tall prairie grasses in material that weathered from limestone. The Claremore soils are in the western and central parts of the county.

The surface layer is dark brown to reddish-brown, medium acid silt loam or heavy silt loam about 10 inches thick. This layer has strong, medium, granular structure. It is easily worked, though it contains a few small fragments of limestone.

The subsoil is reddish-brown, medium acid silty clay loam to clay loam about 14 inches thick. It has strong, medium and coarse, granular structure. This layer is underlain by limestone bedrock at a depth of 18 to 28 inches.

The Claremore soils are moderately well drained; internal drainage is medium to slow. The capacity of these soils to hold water is high. They are susceptible to water erosion.

The Claremore soils are associated with the Newtonia, Sogn, and Summit soils. They are similar to Newtonia soils but have thinner layers. They have thicker layers and are redder than Sogn soils. They are redder throughout and contain less clay than Summit soils.

Claremore silt loam, 0 to 3 percent slopes (CmB).—This gently sloping soil of the uplands is susceptible to water erosion. Included with it in mapping are a few areas of Sogn soils, Newtonia silt loam, and Summit silty clay loam.

A large part of this soil is used for range and pasture seeded to native grasses. Some fields are used for small grain, grain sorghum, and tame pasture. (Capability unit IIIe–5; Loamy Prairie range site)

Collinsville Series

The Collinsville series consists of very shallow, dark-colored, moderately steep or steep soils of the upland prairies. The soils formed under tall prairie grasses from sandstone (fig. 5). They are mainly in the eastern and northwestern parts of the county.

The surface layer is dark grayish-brown or very dark grayish-brown, medium acid stony loam about 5 inches thick. It has moderate, medium, granular structure. This layer is friable when moist and is moderately permeable.

The substratum is medium acid, weathered sandstone that is underlain by sandstone bedrock at a depth of about 10 inches.

Collinsville soils are excessively drained. Their internal drainage is medium, and their capacity to hold water is moderate. They are susceptible to water erosion.

The Collinsville soils differ from the Dennis and Bates soils in having less distinct and thinner horizons and in being generally stony.

Collinsville stony loam (Co).—This is a steep to moderately sloping soil in upland prairies. Slopes range from 3 to 20 percent. Included in mapping are a few small

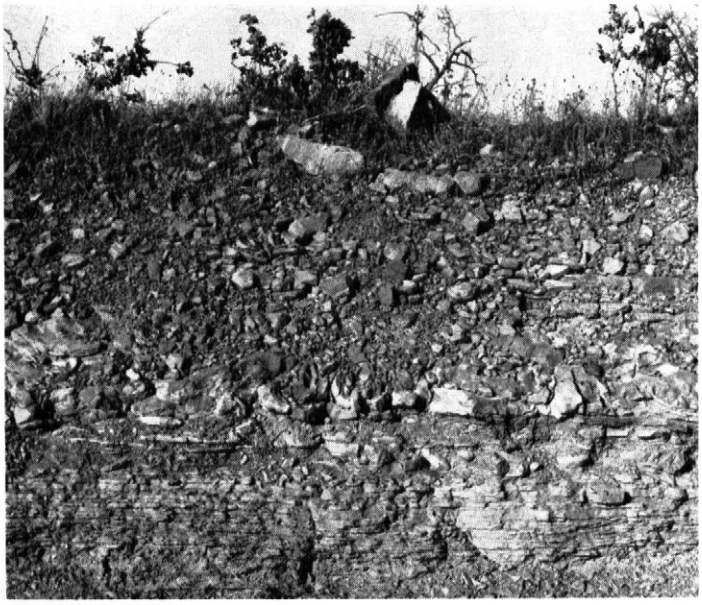

Figure 5.—**Profile of Collinsville stony loam.**

areas of Bates loam and the Bates-Collinsville complex of soils.

This soil is used largely as range consisting of native grasses. (Capability unit VIIs–2; Shallow Prairie range site)

Dennis Series

The Dennis series consists of deep, dark-colored, well-drained soils in the uplands. These soils formed under tall prairie grasses in material that weathered from shale and sandstone (fig. 6) They are well distributed throughout the county.

The surface layer is dark grayish-brown or very dark brown, medium acid silt loam that is easily worked. It ranges from 10 to 16 inches in thickness. This layer has moderate, medium and fine, granular structure. It is friable when moist and is moderately permeable.

The subsoil is strongly acid and is about 20 inches thick. In the upper 4 inches, it is dark grayish-brown or very dark grayish-brown light clay loam that has moderate, medium, granular structure. It is friable when moist and has moderately slow permeability. In the lower part, it is yellowish-brown or dark yellowish-brown clay loam or heavy clay loam that is mottled with red and light gray. This part has strong and moderate, medium, subangular blocky structure. It is firm when moist and has moderately slow permeability.

The substratum is about 16 inches thick. This layer is yellowish-brown or dark yellowish-brown, strongly acid, heavy clay loam mottled with red and yellowish brown. It is massive (structureless), is very firm when moist, and is slowly permeable.

The depth to underlying shale or sandstone ranges from 36 to 60 inches but averages about 50 inches.

The Dennis soils are well drained. They have medium internal drainage, moderately slow permeability, and a high water-holding capacity. These soils are susceptible to water erosion.

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The Dennis soils are associated with Bates, Choteau, Okemah, and Parsons soils. The Dennis soils are finer textured and less permeable than Bates soils. They have thinner layers than the Choteau soils and do not have a light-colored lower surface layer like those soils. They differ from Okemah soils in being more acid, slightly lighter colored, and less clayey. They lack the light-colored lower surface layer and dense claypan subsoil of the Parsons soils.

Dennis-Bates complex, 2 to 5 percent slopes (DbC).—In this complex are gently to moderately sloping soils of the upland prairies. About 50 percent of the acreage is Dennis silt loam, about 40 percent is Bates loam, and the rest is Parsons silt loam and Collinsville soils.

The major problems in using these soils are maintenance of fertility and protection from severe water erosion. The soils are used mainly for pastures and meadows consisting of native grasses, but some fields are used for grain sorghum, small grain, and tame pasture. (Capability unit IIIe–1; Loamy Prairie range site)

Dennis silt loam, 1 to 3 percent slopes (DnB).—This is a gently sloping soil in the upland prairies. Included in mapping are a few small areas of Choteau silt loam, Okemah silty clay loam, and Parsons silt loam.

The major problems in use are the maintenance of fertility and structure and protection from moderate water erosion. A large part of this soil is cultivated. It is well suited to small grain, sorghum, alfalfa, corn, soybeans, and tame and native grasses. (Capability unit IIe–2; Loamy Prairie range site)

Dennis silt loam, 3 to 5 percent slopes (DnC).—This is a moderately sloping soil in upland prairies. Included in mapping are a few small areas of Bates loam and of Parsons silt loam.

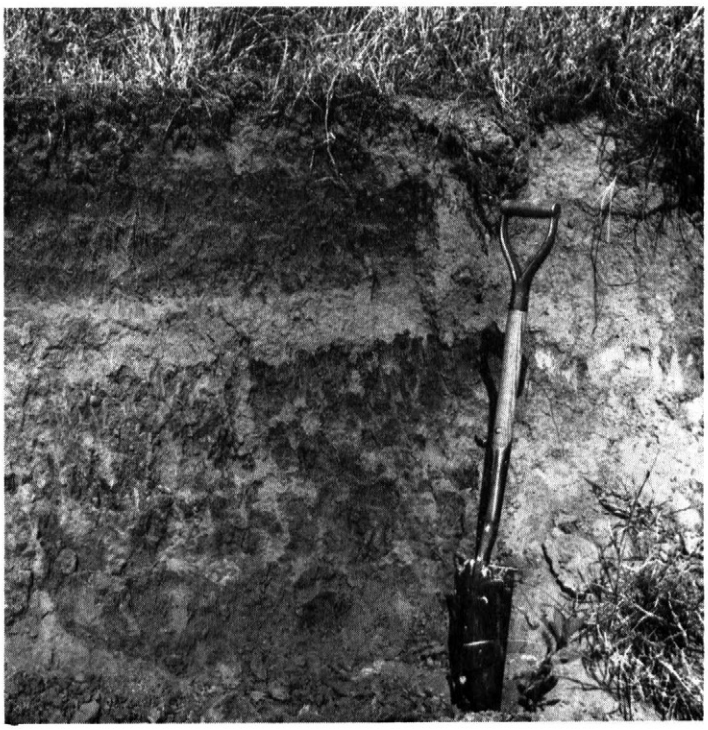

Figure 6.—**Profile of Dennis silt loam under tall native grasses.**

The major problems in use are maintenance of fertility and structure and protection from severe erosion.

The soil is used mainly for pasture or meadow, but some fields are used for small grain, grain sorghum, and corn. (Capability unit IIIe–1; Loamy Prairie range site)

Dwight Series

The Dwight series consists of deep, imperfectly drained, nearly level soils of the upland prairies. These soils formed under prairie grasses in material that weathered from clayey shale.

The surface layer is grayish-brown or very dark grayish-brown, strongly acid silt loam. It has weak, fine, granular structure and is moderately permeable. The thickness ranges from 3 to 6 inches and averages about 5 inches. The texture ranges from silt loam to light silty clay loam.

The subsoil is dark grayish-brown or very dark grayish-brown, medium acid clay that is weakly mottled with light gray and strong brown. It has weak, coarse, blocky structure. The average thickness of this layer is about 40 inches. The subsoil is very slowly permeable. The substratum is weathered clayey shale.

The Dwight soils differ from Parsons soils in having a thinner surface layer that is less gray in lower part.

The Dwight soils are imperfectly drained. Their internal drainage and permeability are very slow.

Dwight silt loam, 0 to 1 percent slopes (DwA).—This is a nearly level, imperfectly drained soil in upland prairies. Included in mapping are a few areas of Parsons silt loam and of Woodson silty clay loam.

The major problems in use are the maintenance of fertility and soil structure, wetness in rainy seasons, and droughtiness in dry seasons. The soil is used mainly for tame or native pasture, but small grain and tame pasture are grown on a few fields. (Capability unit IVs–1; Shallow Claypan range site)

Eroded Loamy Land (Er)

This mapping unit consists of severely eroded areas of Dennis, Summit, Newtonia, Okemah, and Choteau soils. Slopes range from 2 to 8 percent. The soils are gently sloping to strongly sloping and occur in small areas in the uplands throughout the county (fig. 7). This eroded loamy land generally retains less than 25 percent of its original surface layer and has many shallow gullies and a few deep ones. Included in mapping are a few small areas of moderately eroded soils.

The major problems in use are severe erosion, low fertility, poor soil structure, and droughtiness. Most areas of Eroded loamy land are used for pasture or are idle. They are unproductive and are not suited to cultivated crops. (Capability unit VIe–1; Loamy Prairie range site)

Gravel Pits (Gp)

Gravel pits are gravelly areas from which most of the gravel has been excavated. The deep deposits of water-laid gravel in these areas provide good material for building roads and are used extensively for county roads.

This land type has no distinct soil profile. The areas are of limited use for agriculture and are used mainly as a wildlife refuge. (Capability unit VIIIs–1; not assigned to a range site)

Hector Series

The Hector series consists mainly of shallow stony sandy loam soils in the uplands. These soils formed under hardwood trees from sandstone, mainly in eastern and northeastern parts of the county.

The surface layer is about 12 inches thick. The upper part is brown or dark-brown, strongly acid stony sandy loam that has weak, granular structure. It is very friable when moist. This part contains a few sandstone fragments. The lower part is reddish-yellow or strong-brown, strongly acid fine sandy loam that is massive (structureless). It is very friable when moist. This layer contains many sandstone fragments.

The substratum is strongly acid, weathered sandstone underlain by bedrock at a depth of about 18 inches.

The Hector soils are associated with the Linker soils and differ from them mainly in having less distinct and thinner horizons.

Hector stony sandy loam (Hc).—This is a shallow, moderately sloping or steep soil in the forested uplands. Generally, it is excessively drained and stony. Slopes range from 3 to 30 percent. Included in mapped areas of this soil are a few small areas of Rough stony land, Linker fine sandy loam, and Collinsville stony loam.

The major problems in use are shallowness, steepness, stoniness, low fertility, and control of brush. The soil is used mainly for woodland pasture, but a few fields are cleared and planted to tame pasture. (Capability unit VIIs–1; Shallow Savannah range site)

Hector-Linker fine sandy loams, 1 to 5 percent slopes (HlC).—The moderately sloping sandy soils in this complex developed under hardwood trees in the uplands. About 70 percent of the complex is Hector fine sandy loam, and 22 percent is Linker fine sandy loam. The rest is Hector stony sandy loam, Bates loam, and other minor soils. The Hector fine sandy loam in this unit has thicker layers and fewer stones in the surface layer than is characteristic of the Hector series. The Linker fine sandy loam in this unit has thinner horizons than is characteristic of the Linker series.

The major problems in use are protection from water erosion, control of brush, and maintenance of fertility and structure. The soils in this unit are used mainly as tame or woodland pasture, but a few fields are used for small grain, grain sorghum, and corn. (Both soils, capability unit IVe–2; Hector part, Shallow Savannah range site; Linker part, Sandy Savannah range site)

Linker Series

In the Linker series are deep, well-drained, moderately coarse textured soils that are gently to moderately sloping and are in the uplands. These soils developed under hardwood trees and prairie grasses from sandstone. They are mainly in the central and northeastern parts of the county.

The surface layer is about 16 inches thick. The upper part is brown or dark-brown, strongly acid fine sandy loam. It has weak, fine, granular structure. This part is very friable when moist and is moderately permeable. The lower part is similar but is pale brown or yellowish brown.

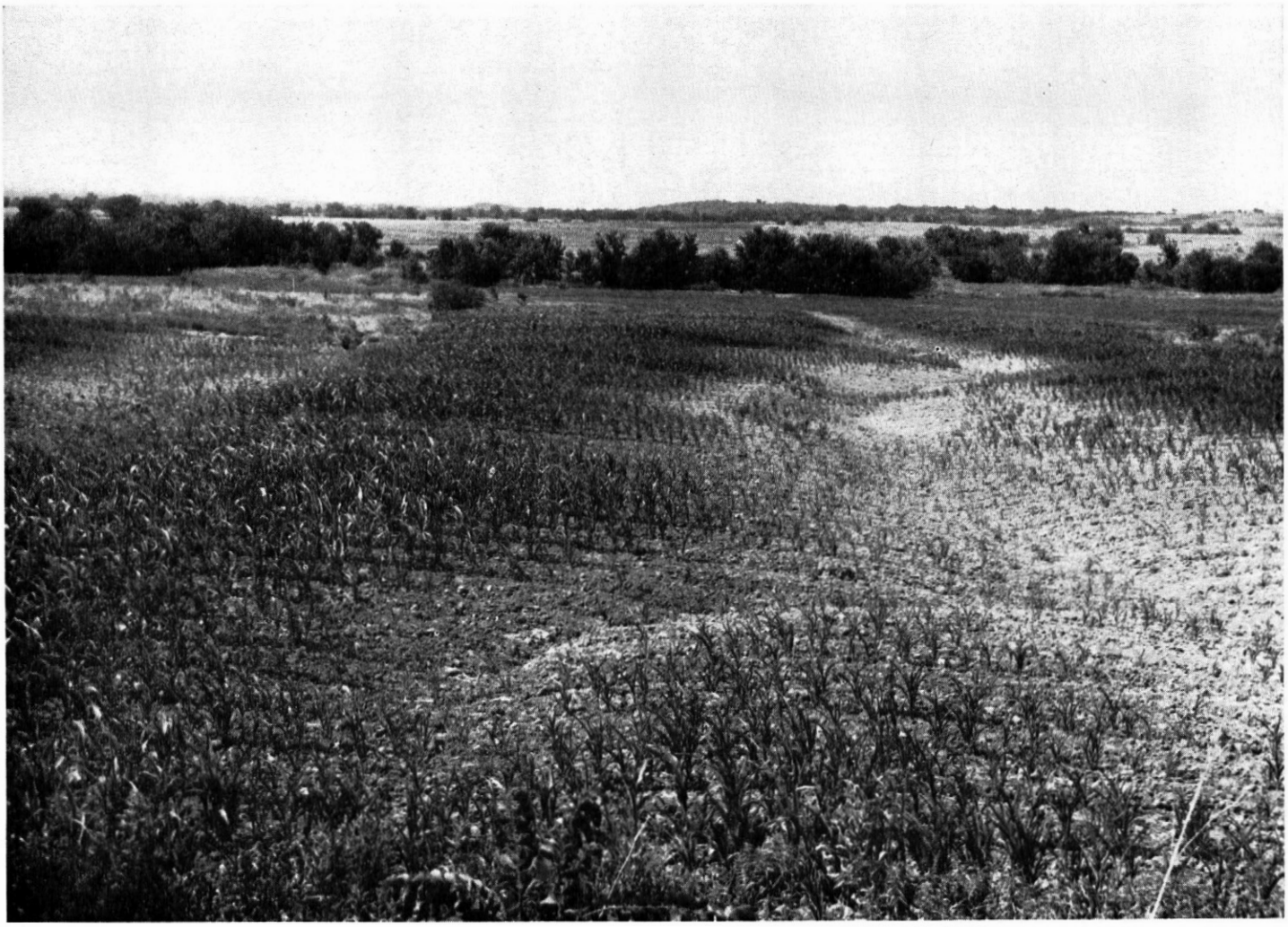

Figure 7.—**Unprotected, severely eroded field of Dennis soils.**

The subsoil is about 24 inches thick. The upper part is yellowish-red, strongly acid sandy clay loam with many, prominent mottles of yellowish brown, reddish brown, and reddish yellow. This layer has weak, medium, subangular blocky structure. It is firm when moist and has moderately slow permeability. The lower part is reddish-yellow or strong-brown, medium acid sandy clay loam. It has strong, medium, subangular blocky structure. Sandstone bedrock is at a depth of about 40 inches.

The Linker soils are naturally well drained. Their internal drainage is medium. Their capacity to hold water is moderate. The Linker soils are susceptible to water erosion.

The Linker soils differ from the Hector soils in having deeper and more distinct horizons.

Linker fine sandy loam, 1 to 3 percent slopes (LkB).—This gently sloping soil is in the uplands. Included in mapping are a few small areas of Bates loam and Hector fine sandy loam.

Linker fine sandy loam, 1 to 3 percent slopes, is subject to moderate water erosion. The maintenance of fertility and structure and control of brush are also problems in use. The soil is used largely for tame or woodland pasture. (Capability unit IIe–3; Sandy Savannah range site)

Linker fine sandy loam, 3 to 5 percent slopes (LkC).—This moderately sloping soil is in the uplands. It developed under hardwood trees from sandstone. Included in mapping are a few areas of Hector fine sandy loam.

This soil is subject to severe water erosion. The maintenance of fertility and soil structure are problems in use. Control of brush is necessary in pastures.

This soil is used largely for tame and woodland pasture. (Capability unit IIIe–3; Sandy Savannah range site)

Newtonia Series

The Newtonia series consists of deep, reddish-brown, well-drained soils in the uplands. These soils developed under tall prairie grasses in material that weathered from limestone or calcareous shale. Newtonia soils are in the western and central parts of the county.

The surface layer is dark-brown, reddish-brown, or dark reddish-brown silt loam about 14 inches thick. It is easily worked. To the depth normally plowed, this layer has

moderate, medium, granular structure and is medium acid, but below that depth it has moderate, coarse, granular structure and is slightly acid.

The subsoil is about 18 inches thick. The upper part is reddish-brown to dark reddish-brown, neutral light silty clay loam that has strong, coarse, granular structure. The lower part is red to dark-red, neutral silty clay loam that has weak, medium, subangular blocky structure.

The substratum is about 8 inches thick. It is mildly alkaline, red silty clay loam with a few cherty limestone fragments. The depth to limestone bedrock or shale averages about 40 inches but ranges from 24 to 74 inches.

Newtonia soils are naturally well drained. Their internal drainage is medium. Their capacity to hold water is high. These soils are susceptible to water erosion.

The Newtonia soils are associated with Summit and Sogn soils. The Newtonia soils are redder in all layers and are more permeable than the Summit soils. They are deeper and have more distinct horizons than the Sogn soils.

Newtonia silt loam, 0 to 1 percent slopes (NaA).—This nearly level soil formed from limestone in upland prairies. Included with this soil in mapping are a few small areas of Summit silty clay loam and Claremore silt loam.

This soil is generally very fertile and is used mainly for cultivated crops. Some areas, however, are used for native grass pasture or hay. The soil is well suited to small grain, sorghum, alfalfa, corn, soybeans, and tame and native grasses. (Capability unit I–1; Loamy Prairie range site)

Newtonia silt loam, 1 to 3 percent slopes (NaB).—This gently sloping soil formed from limestone in upland prairies. Included in mapping are a few small areas of Summit silty clay loam and Claremore silt loam.

The major problems in use of this soil are the maintenance of fertility and protection from water erosion. Most areas are used for cultivated crops, but a few are used for native grass pasture or hay. The soil is well suited to small grain, sorghum, corn, alfalfa, soybeans, and tame and native grasses. (Capability unit IIe–2; Loamy Prairie range site)

Okemah Series

The Okemah series consists of deep, dark-colored, moderately well drained soils in the uplands. These soils developed under tall prairie grasses in material that weathered from clayey shale. These soils are well distributed throughout the county.

The surface layer is silty clay loam about 14 inches thick. The texture, however, ranges from heavy silt loam to silty clay loam. The upper part is dark gray or black and has medium granular structure. It is firm when moist, is moderately permeable, and is medium acid. The lower part is dark gray or very dark grayish brown and has fine, faint mottles of dark brown. This part has strong, medium, granular structure and is firm when moist. It is moderately permeable and is slightly acid.

The subsoil is about 21 inches thick. The upper part is dark grayish-brown or very dark grayish-brown, slightly acid heavy silty clay loam that has strong, medium, granular structure. The lower part is dark yellowish-brown, neutral clay that has common, fine, faint mottles of strong brown. This lower part has strong, medium, blocky structure, is firm when moist, and is slowly permeable.

The substratum is massive, moderately alkaline clay with common, medium, faint mottles of yellowish brown. This layer contains many gypsum crystals. It is slowly permeable. Depth to shale or sandstone ranges from 36 to 82 inches.

The Okemah soils are moderately well drained. Their internal drainage is slow. Their capacity to hold water is high. The soils are susceptible to water erosion.

The Okemah soils are associated with the Dennis, Parsons, Taloka, and Woodson soils. They are darker and less acid than the Dennis soils. The Okemah soils differ from the Parsons and Taloka soils in having a darker, less acid surface layer and a more permeable, less acid subsoil. They have a more permeable surface soil and subsoil than the Woodson soils.

Okemah silty clay loam, 0 to 1 percent slopes (OkA).—This nearly level soil is in upland prairies. Included with it in mapping are a few areas of Parsons silt loam, Woodson silty clay loam, Taloka silt loam, and Summit silty clay loam.

This soil is used largely for cultivated crops, but some fields are used for native grass pasture or hay. The crops generally grown on this soil are small grain, sorghum, corn, and tame pasture. (Capability unit I–1; Loamy Prairie range site)

Okemah silty clay loam, 1 to 3 percent slopes (OkB).—This gently sloping soil is in the upland prairies. Included with it in mapping are a few small areas of Choteau silt loam, Dennis silt loam, Woodson silty clay loam, and Summit silty clay loam.

The major problems in use of this soil are protection from water erosion and the maintenance of fertility and structure. Small grain, sorghum, corn, and tame pasture are grown on a large part of the acreage; the rest is used for native grass pasture. (Capability unit IIe–1; Loamy Prairie range site)

Okemah silty clay loam, 1 to 3 percent slopes, eroded (OkB2).—This eroded, gently sloping soil is in the uplands. It has a much thinner surface layer than the uneroded Okemah soils. In some areas, subsoil material is exposed and gullies have formed. Included in mapping are a few areas of moderately eroded Summit silty clay loam. Severe water erosion, low fertility, poor soil structure, and droughtiness are major problems in use of this soil. Most areas are used for tame pasture, but some are used for grain sorghum and small grain. Yields, however, are low. (Capability unit IIIe–4; Loamy Prairie range site)

Osage Series

The Osage series consists of deep, dark-colored, clayey, poorly drained soils of the bottom lands. These soils formed under trees and tall grasses in recent alluvium along major streams, mainly in the central part of the county.

The surface layer is dark-gray, very dark gray, or black, slightly acid clay about 22 inches thick. The thickness, however, ranges from 10 to 28 inches. The soil has strong, medium, subangular blocky structure.

The substratum is clayey alluvium that is massive (structureless), very slowly permeable, and slightly acid. Mottling in this layer is highly variable.

Osage clay (Os).—This is a nearly level, imperfectly drained soil of the bottom lands. Slopes range from 0 to 1 percent. Included in mapping are a few areas of Verdigris clay loam and Verdigris silt loam.

The major problems are poor drainage, difficulty of tillage, flooding, and control of brush. The cleared areas are used mainly for tame pasture and the production of pecans. The wooded areas are used mainly for woodland pasture. If it is drained and managed well, this soil is moderately productive. (Capability unit IIIw–1; Heavy Bottomland range site)

Parsons Series

The Parsons series consists of deep, grayish-brown soils with a claypan subsoil (fig. 8). They formed in old alluvium or valley fill material in upland prairies. They are well distributed throughout the county.

The silt loam surface layer is about 11 inches thick. The thickness, however, ranges from 8 to 16 inches. The upper 8 inches is grayish brown or very dark grayish brown and has weak, medium, granular structure. It is friable when moist, is moderately permeable, and is slightly acid. The lower part of the surface layer is light brownish gray or dark grayish brown and has weak, fine, granular structure. It is friable when moist, is moderately permeable, and is strongly acid.

The claypan subsoil is about 29 inches thick. The upper part is dark grayish-brown or very dark grayish-brown clay that has few, fine, reddish-brown and yellowish-brown mottles. This part has weak, medium, blocky structure. It is very firm when moist, is very slowly permeable, and is medium acid. The lower part is light yellowish brown or yellowish brown, has many mottles, and is slightly acid.

The substratum is neutral clayey old alluvium.

The Parsons soils are somewhat poorly drained. Their internal drainage and permeability are very slow.

Figure 8.—**Profile of Parsons silt loam, 0 to 1 percent slopes.**

The Parsons soils are associated with the Dwight, Taloka, Okemah, and Dennis soils. They have a thicker surface layer than the Dwight soils. They have a thinner surface layer and a browner subsoil than the Taloka soils. The Parsons soils are lighter colored in the lower part of their surface layer and have a finer textured and more slowly permeable subsoil than the Okemah and Dennis soils.

Parsons silt loam, 0 to 1 percent slopes (PaA).—This nearly level soil has a claypan subsoil and is in upland prairies. The claypan subsoil makes this soil very slowly permeable and causes a temporarily high water table during wet seasons. It also causes this soil to be droughty in dry seasons. Included in mapping are a few areas of Taloka silt loam, Dwight silt loam, Woodson silty clay loam, and Okemah silty clay loam.

The major problems in use are the maintenance of soil structure and fertility and, in some areas, surface drainage. A large part of the acreage is used for small grain, grain sorghum, and tame pasture; the rest is used for native grass pasture or hay. (Capability unit IIs–1; Claypan Prairie range site)

Riverton Series

The Riverton series consists of deep loam or gravelly loam soils of the uplands. These soils formed under tall prairie grasses in old alluvium. They are on high terraces along the Verdigris River and are gently sloping to moderately sloping.

The surface layer is about 8 inches thick and is generally reddish-brown or dark reddish-brown loam. The texture, however, ranges from fine sandy loam to silt loam. This layer has moderate, medium, granular structure. It is friable when moist, is moderately permeable, and is medium acid.

The subsoil is about 32 inches thick. The upper part is red or dark-red light clay loam that has moderate, medium, granular structure. It is moderately permeable and is medium acid. The lower part is red gravelly clay loam that is moderately permeable and is slightly acid.

The substratum is gravelly alluvium that is slightly acid. The depth to gravel ranges from 26 to 48 inches.

The Riverton soils are naturally well drained. Their internal drainage is rapid, their permeability is moderate, and their capacity to hold water is fair. The soils are susceptible to water erosion.

A large acreage of Riverton soils is used for pasture. A few fields are used for small grain, grain sorghum, and tame pasture.

Riverton loam, 1 to 3 percent slopes (RmB).—This gently sloping soil is in the upland prairies. Included in mapping are a few small areas of Riverton gravelly loam, Choteau silt loam, and Bates loam.

This soil is typical of the Riverton series. It is well drained, is moderately permeable, and has a moderate capacity to hold water. Erosion and low fertility are the major problems in use. A large part of the acreage is used for tame pasture, but a few fields are used for small grain, grain sorghum, and corn. (Capability unit IIe–2; Loamy Prairie range site)

Riverton gravelly loam, 3 to 5 percent slopes (RvC).—This moderately sloping, gravelly soil is in the upland prairies. The soil is well drained, is moderately permea-

ble, and has a low capacity to hold water. Included in mapping are a few small areas of Riverton loam, Choteau silt loam, and Bates loam.

The major problems in use are the maintenance of soil fertility and structure and protection from erosion. A large part of the acreage is used for pasture, but a few fields are used for small grain, grain sorghum, and tame pasture. (Capability unit IIIe–1; Loamy Prairie range site)

Riverton gravelly loam, 3 to 5 percent slopes, eroded (RvC2).—This eroded, moderately sloping, gravelly soil is in the upland prairies. It has a much thinner surface layer than the uneroded Riverton gravelly loam. In some areas the subsoil material is exposed and gullies have formed. Included with this soil in mapping are a few areas of Riverton loam and Bates loam.

The major problems in use are the maintenance of fertility and soil structure, protection from severe erosion, and droughtiness. This soil is used largely for pasture. (Capability unit IIIe–4; Loamy Prairie range site)

Rough Stony Land (Rs)

This land type occurs on very steep, stony breaks, mainly in the central part of the county along the Verdigris River. Slopes range from 20 to 35 percent. The sandstone, shale, and limestone parent materials are so mixed that it is difficult to identify individual soils.

The acreage of this land type is used mainly as woodland pasture. Because of steep slopes, very shallow soil material, and stoniness, this land type has little value for pasture or for woodland. (Capability unit VIIs–4; Savannah Breaks range site)

Sogn Series

The Sogn series consists of very shallow, dark-colored soils in the uplands. These soils formed under tall prairie grasses from limestone. The Sogn soils are mainly in the western and central parts of the county.

The surface layer is dark grayish-brown or very dark grayish-brown, moderately alkaline silty clay loam about 8 inches thick. This layer has coarse granular structure and is friable when moist. It contains a few limestone rock fragments and is underlain by limestone bedrock.

The Sogn soils differ from Newtonia and Summit soils in having less distinct and thinner horizons. Also, the Sogn soils are generally stony.

Sogn soils (So).—These stony, moderately sloping or steep soils developed under prairie grasses from limestone (fig. 9). Slopes range from 3 to 20 percent. Included in mapping are a few small areas of Newtonia silt loam, Claremore silt loam, and Summit silty clay loam.

The major problems in use are shallowness, stoniness, and droughtiness. These soils are used for range or pasture seeded to native grasses. (Capability unit VIIs–3; Very Shallow range site)

Strip Mines (Sm)

This land type consists of steep, irregularly sloping dumps of well-mixed shale, sandstone, and the original mantle of soil stripped from coalbeds. Runoff is rapid, and the areas are susceptible to water erosion.

Figure 9.—Sogn soils in native grass.

A large part of the acreage is idle. Some areas have been seeded to sweetclover, fescue, Korean lespedeza, and sericea lespedeza for tame pasture. In some of the older areas, stands of native grasses have become established where a source of seed was near. (Capability unit VIIe–1; Coal Strip Mines range site)

Summit Series

The Summit series consists of very dark, well-drained, gently sloping to moderately sloping soils in the uplands (fig. 10). The soils formed under tall prairie grasses from limestone and calcareous shale. They are in the central and western parts of the county.

The surface layer is a very dark gray or black, neutral silty clay loam about 14 inches thick. The thickness, however, ranges from 12 to 18 inches. This layer has moderate, medium and coarse, granular structure. It is friable when moist and has moderately slow permeability.

The subsoil is about 22 inches thick. The upper part is dark-gray or very dark grayish-brown, slightly acid light silty clay. It has strong, medium and fine, granular structure. It is firm when moist. The lower part is dark grayish-brown or very dark grayish-brown neutral clay with common, fine, distinct mottles of dark gray and dark grayish brown. It has moderate, fine, blocky structure. It is very firm when moist and is slowly permeable.

The substratum consists of about 11 inches of neutral to alkaline, massive, clayey material underlain by limestone or shale. The depth to limestone bedrock or shale ranges from 30 to 70 inches.

The Summit soils are moderately well drained. Their internal drainage is medium, and their permeability is moderately slow. They are susceptible to water erosion.

The Summit soils are associated with Newtonia, Sogn, and Woodson soils. They are much darker in color than Newtonia soils. They have a thicker and more granular surface layer than Woodson soils and do not have a claypan subsoil like those soils. Summit soils are deeper and have more distinct horizons than Sogn soils.

Summit silty clay loam, 1 to 3 percent slopes (SuB).—This is a gently sloping soil in the uplands. It formed

under prairie grasses from limestone. Included with it in mapping are a few areas of Newtonia silt loam, Claremore silt loam, and Woodson silty clay loam.

This soil is susceptible to water erosion, and management is required that maintains fertility and soil structure. A large part of the soil is used for small grain, grain sorghum, corn, soybeans, and tame pasture; some fields are used for native grass pasture or hay. (Capability unit IIe–1; Loamy Prairie range site)

Summit silty clay loam, 3 to 5 percent slopes (SuC).—This is a moderately sloping soil that formed under prairie grasses in the uplands. Included in mapping are a few areas of Okemah silty clay loam, Newtonia silt loam, and Dennis silt loam.

The major problems in the use of this soil are protection from severe water erosion and the maintenance of fertility and structure. A large part of the soil is in cultivated crops. The soil is suited to small grain, grain sorghum, corn, soybeans, and tame and native pasture grasses. (Capability unit IIIe–2; Loamy Prairie range site)

Summit silty clay loam, 1 to 5 percent slopes, eroded (SuC2).—This moderately sloping soil is in the uplands. It has a thinner surface layer than the soil described for the Summit series. In some areas subsoil material is exposed and gullies have formed.

The major problems in use are a severe hazard of water erosion, poor tilth, and low fertility. A large acreage of this soil is used for tame pasture, but some fields are used for small grain and grain sorghum. (Capability unit IIIe–4; Loamy Prairie range site)

Taloka Series

The Taloka series consists of deep, grayish-brown soils that have a claypan subsoil and are in the upland prairies. These soils formed in old alluvium or valley fill material. They are well distributed throughout the county.

The surface layer is silt loam about 22 inches thick. The thickness, however, ranges from 16 to 26 inches. In the upper 12 inches, the surface layer is grayish brown or very dark grayish brown. This part has moderate, medium, granular structure. It is friable when moist, is moderately permeable, and is medium acid. The lower part ranges from 5 to 15 inches in thickness and is pale brown or brown. It has fine, granular structure. It is friable when moist, is moderately permeable, and is medium acid.

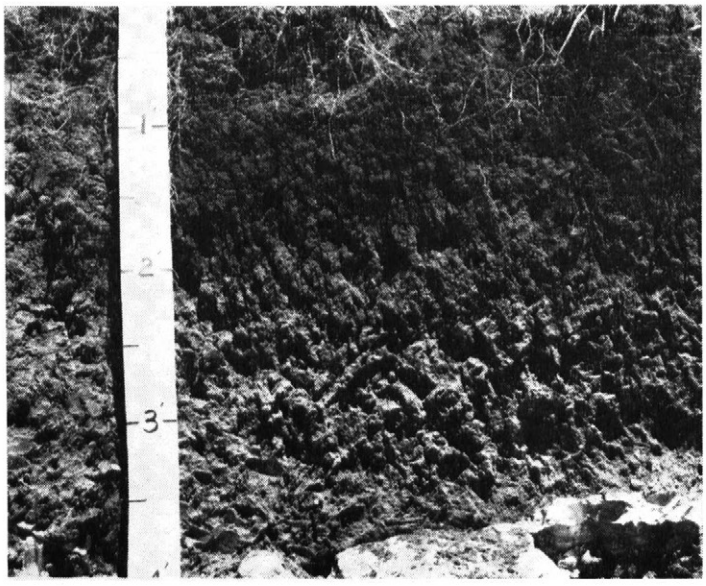

Figure 10.—**Profile of Summit silty clay loam, 1 to 3 percent slopes.**

The claypan subsoil is about 22 inches thick. The upper part is grayish-brown or dark grayish-brown clay with many, medium, distinct mottles of yellowish brown and dark red. This part has weak, medium, blocky structure. It is very slowly permeable and is slightly acid. The lower part is similar to the upper part but is brownish yellow and is massive. The substratum is clayey alluvium.

The Taloka soils are somewhat poorly drained. Their internal drainage and permeability are very slow.

These soils are associated with the Parsons, Choteau, and Okemah soils. The Taloka soils have a thicker surface layer than Parsons soils. They have a finer textured, darker, and less permeable subsoil than Choteau soils. The Taloka soils differ from Okemah soils in having a lighter colored and less clayey surface layer, and a more clayey and less permeable subsoil.

Taloka silt loam, 0 to 1 percent slopes (TaA).—This nearly level soil has a claypan subsoil and is in the upland prairies. Included with it in mapping are a few areas of Parsons silt loam, Choteau silt loam, and Okemah silty clay loam.

The major problems in using this soil are maintenance of fertility and soil structure. A large part of this soil is in cultivated crops. The soil is suited to small grain, sorghum, corn, soybeans, and tame and native pasture. (Capability unit IIs–1; Loamy Prairie range site)

Verdigris Series

The Verdigris series consists of deep, dark-colored, moderately well drained soils on bottom lands. These soils formed under trees and tall grasses in recent alluvium along the major streams, mainly in the central part of the county.

The surface layer is about 32 inches thick. The upper part is dark grayish-brown or very dark grayish-brown silt loam. It has moderate, medium, granular structure. It is friable when moist and is slightly acid. The lower part is heavy silt loam that is neutral and shows a few faint mottles of light yellowish brown. The substratum is silty or clayey neutral alluvium.

The texture of the surface layer and substratum ranges from silt loam to clay loam. In the less well drained areas, the substratum is more mottled with browner and grayer shades.

Verdigris silt loam (Vd).—This nearly level soil is on bottom lands. Slopes range from 0 to 1 percent. Included in mapping are a few small areas of Verdigris clay loam and Osage clay.

This soil is used largely for cultivated crops (fig. 11). It is suited to corn, small grain, soybeans, sorghum, tame pasture, and pecan trees. (Capability unit IIw–1; Loamy Bottomland range site)

Verdigris clay loam (Ve).—This nearly level soil is on bottom lands that are flooded during wet seasons. Slopes range from 0 to 1 percent. Included in mapping are a few

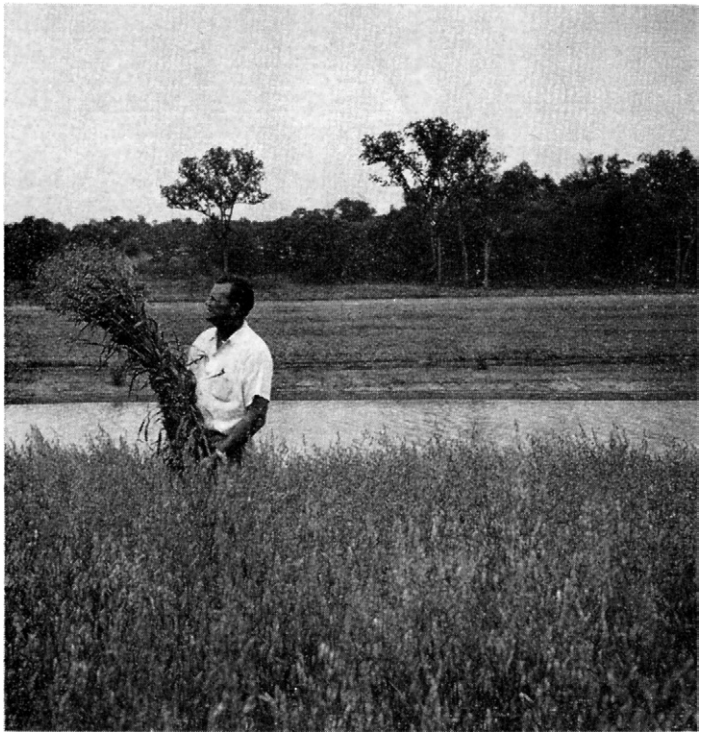

Figure 11.—Oats on newly cleared Verdigris silt loam.

small areas of Verdigris silt loam and Osage clay. This soil is used mainly for cultivated crops. It is suited to corn, small grain, sorghum, soybeans, tame pasture, and pecan trees. (Capability unit IIw–1; Loamy Bottomland range site)

Verdigris soils, frequently flooded (Vf).—These soils are in low, narrow strips on bottom lands along large streams. Included in mapping are some narrow stream channels and breaks. The texture of soils in this unit ranges from silty clay loam to fine sandy loam. The slopes range from 0 to 15 percent.

Because they are frequently flooded and have irregular slopes, these soils are not suited to cultivated crops. They are used mainly for woodland pasture or as wildlife habitats. (Capability unit Vw–1; Loamy Bottomland range site)

Woodson Series

The Woodson series consists of deep, dark-gray soils that have a claypan subsoil and are in uplands. They formed under tall prairie grasses in material that weathered from clayey shale.

The surface layer is gray or very dark gray, strongly acid silty clay loam about 10 inches thick. The thickness, however, ranges from 6 to 14 inches. This layer has weak, fine, granular structure. It is firm when moist and is slowly permeable.

The subsoil is about 38 inches thick. The upper 20 inches is dark gray or very dark gray and is very compact. Structure ranges from weak, fine, blocky to massive. This layer is very slowly permeable and is medium acid. The lower part is gray or dark gray clay. It is extremely firm when moist and is slightly acid.

The substratum is gray, massive clay that is neutral and very slowly permeable. Depth to shale or to clay ranges from 36 to 72 inches.

Woodson soils are associated with the Parsons, Okemah, and Summit soils. They have a surface layer that is darker and finer textured than that in the Parsons soils and that is not light colored in the lower part. Woodson soils are finer textured and less permeable than Okemah soils. In Rogers County the Woodson soils are mapped only in an undifferentiated unit with the Summit soils.

Woodson and Summit soils, 0 to 1 percent slopes (WsA).—These are nearly level soils in upland prairies. About 80 percent of this undifferentiated unit consists of Woodson soils, and about 11 percent consists of Summit soils. A few areas of Okemah and Parsons soils are included in mapping and make up the rest.

The major problems in use of these soils are maintenance of fertility and soil structure. Most areas of this unit are used for pasture and meadow. Some areas are used for small grain, grain sorghum, and tame pasture. (Capability unit IIs–2; Claypan Prairie range site)

Use and Management of the Soils

In the first part of this section, the management of the soils for crops and pasture is discussed. In this part the soils are grouped by capability classes, subclasses, and units, and management is described for each capability unit. Average yields for principal crops under both ordinary and improved management are predicted in table 2. This table is followed by separate subsections on management of soils for range, wildlife, and woodland.

General Management of Soils for Cultivated Crops and Tame Pasture[1]

Presented here are those general practices of management appropriate for practically all the soils in Rogers County. Those practices that apply in production of cultivated crops are first discussed, and then those for tame pasture.

General management of soils for cultivated crops

For cultivated crops, the main management problems in the county are (1) protecting the soils from erosion, (2) conserving moisture, and (3) maintaining fertility, the content of organic matter, and good tilth. The information in this section can be used with that in the subsection "Management by Capability Units" to help the landowner select the practices appropriate for the soils on his farm or ranch. The yields to be expected under customary management and under improved management given in table 2 can be used as an additional guide in selecting a system of management for an individual farm.

Most good management practices accomplish more than one purpose and can be used on nearly all of the cropland in the county. In the following paragraphs, practices basic to good farming are discussed briefly.

Minimum tillage.—If soils are to be cropped, they must be worked to prepare a seedbed, to control weeds, and to

[1] By E. O. Hill, conservation agronomist, and Myron A. Hurd, work unit conservationist, Soil Conservation Service.

provide a favorable place for the growth of plant roots. Excessive tillage, however, breaks down the soil structure and speeds up the decomposition of organic matter. The soils then tend to puddle and to crust at the surface, to take in less water and air, and to store less moisture for plant growth.

Minimum tillage is accomplished by (1) using a long cropping system with perennial grasses or deep-rooted legumes, (2) using herbicides instead of cultivation for weed control, and (3) reducing the number of operations in preparing the seedbed, planting, and cultivating. Tilling is expensive, and by eliminating extra operations, money and time can be saved. Also, in most places, the soil can be improved and the yields increased.

Soil-improving crops.—The main objectives in using soil-improving crops are to maintain or improve the physical condition and the productivity of the soil and to control erosion, weeds, insects, and diseases. A cropping system that improves the soil includes grasses, legumes, and other crops that produce large amounts of residue.

A list of the principal legumes, grasses, and other crops used to improve soils in the county follows:

Legumes: Alfalfa, soybeans, mungbeans, hairy vetch, annual lespedeza, sericea lespedeza, and sweetclover are suitable soil-improving legumes, if all or a large part of the top growth is returned to the soil.

Grasses: Fescue, brome, rye, barley, ryegrass, sudangrass, and lovegrass can be used as soil-improving crops if all or a large part of the top growth is returned to the soil. These crops are generally used as supplemental pasture and then turned under. Nearly all of these crops are well adapted to the soils cultivated in the county.

Other crops: Small grain, grain sorghum, corn, and other crops that produce large amounts of residue are soil improving, provided only the grain is harvested and the residue is left on the soil. When large amounts of straw or other crop residue are worked into the soil, it is desirable to apply 20 to 40 pounds of nitrogen to aid decomposition and to prevent a shortage of nitrogen for the succeeding crop.

Soil-depleting crops.—Crops grown under management that allows soil erosion, deterioration of soil structure, and reduction of the organic-matter content are soil-depleting crops. Minimum use of these crops is made in a good cropping system. Clean-tilled crops, if the forage is removed for silage or cut low for bundle feeds, and soybeans cut for hay, are soil-depleting crops. Also, close-growing, or sown crops, such as alfalfa and small grain, are soil depleting if most of the top growth is removed each year.

Plowpan.—When tillage implements are used too often to the same depth, the soil is compacted, and a plowpan results. This pan is just below plow depth. It reduces aeration, moisture penetration, and normal root growth. Plowpans can be eliminated by varying the depth of tillage or by using perennial grasses and deep-rooted legumes in the cropping system.

Cover crops.—Cover crops usually consist of small grain with vetch or annual lespedeza grown to protect and to improve the soil. Small grain, overseeded with annual lespedeza that is often harvested for hay or for seed, is the main warm-season cover crop. Small grain and vetch are good cool-season cover crops. The experience of farmers proves that benefits from cover crops more than offset their cost.

Crop residue management.—Leaving crop residue on the surface during winter and spring, or working it partly into the surface, is a good farming practice. Organic matter, or humus, supplied in crop residue improves the tilth of the surface soil. This, in turn, increases infiltration and storage of water, reduces soil erosion, and helps to prevent crusting.

Fertilizing and liming.—In this area of relatively high rainfall, most cultivated soils have been made poor by the intensive use of soil-depleting crops for many years. Most of the soils are moderately acid. Therefore, if alfalfa, sweetclover, or other plants that require much lime are grown, an application of limestone is required for successful growth and maintenance of these plants.

Fertilizer and lime should be applied according to current recommendations of local agricultural agencies. The amount used should be based on soil tests, soil characteristics and production capacity, past use and treatment, and other known factors as well as on the desires and resources of the farmer.

Field terraces and diversion terraces.—A terrace is a ridge, or a combination of a ridge and a channel, built across the slope, usually on a slight grade, to divert or to slow the flow of water. Terraces reduce erosion and conserve moisture. They also serve as guidelines for contour farming. The differences between a field terrace and a diversion terrace are mainly those of size and purpose. A field terrace is designed mainly to slow the movement of water on cropland; a diversion terrace is designed to protect a field from damage by runoff from adjoining higher land.

Field terraces increase the intake of water and improve crop yields in this county, as limited moisture during summer is an obstacle to good yields. The broad base, channel-type terrace is suitable for this county, since large equipment is used extensively.

Contour farming.—Tilling soils on the contour, instead of up and down the slope, has many advantages. In contour farming less water erosion occurs, more water soaks into the soil, and crops grow better because usually more moisture is available. Also, stands of crops are more even, and the plants tend to be more uniform in size. Contour farming is necessary for efficient control of erosion and for maintenance of terraces.

Grassed waterways.—Grassed waterways consist mainly of broad, flat-bottomed channels seeded or sodded with perennial plants. Bermudagrass or native grasses are commonly used to provide vegetation. A retaining dike on each side is used if needed. Grassed waterways are needed on all soils in the county where excess water must be removed without causing erosion. They are not designed to control floodwater from creeks, rivers, or large drainage areas.

Each waterway must be designed individually. The width, depth, and kind of vegetation needed are determined primarily by the size of the area drained, the grade, and soil permeability. Also important are the established erosion control practices and plant cover over the drainage area.

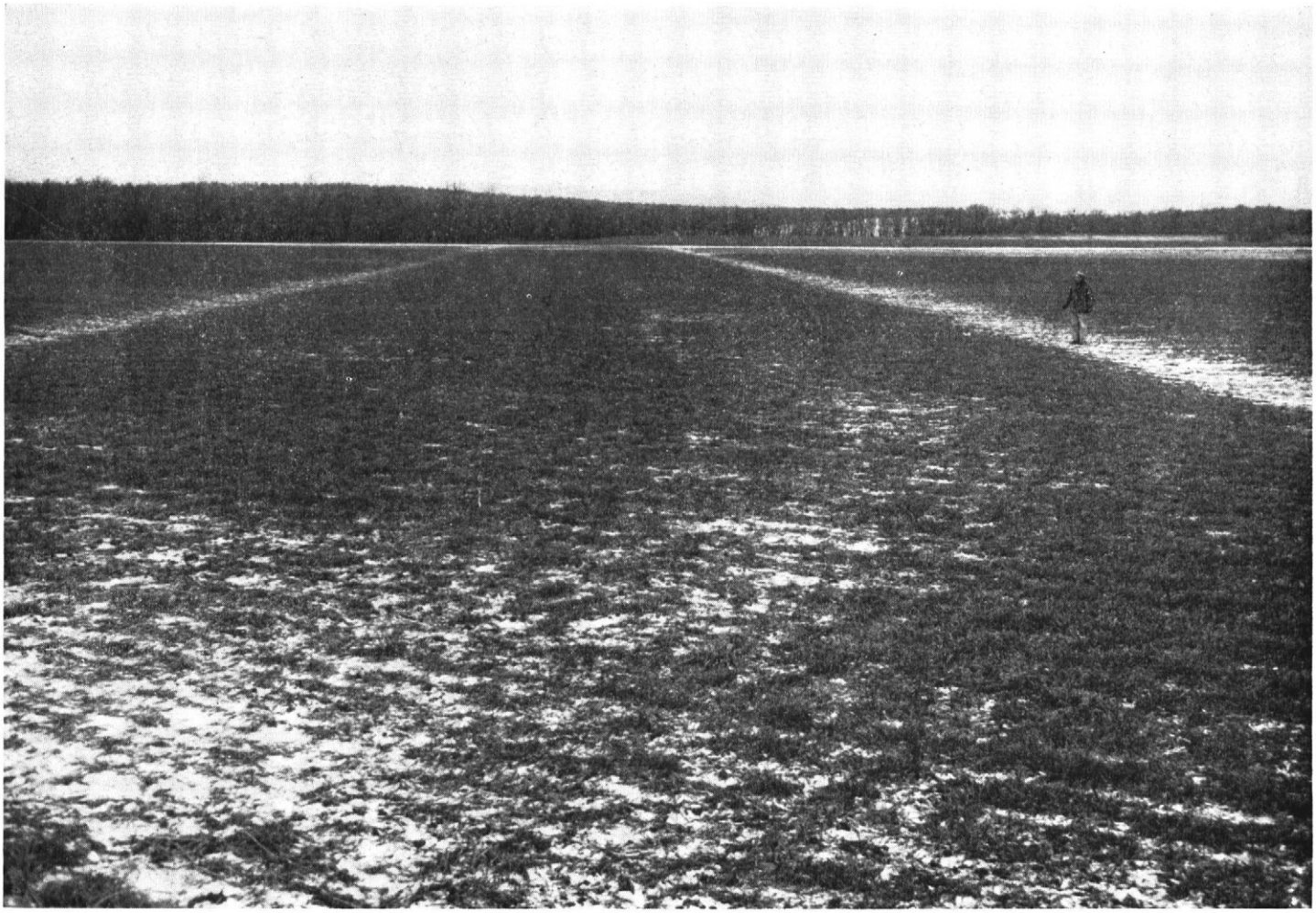

Figure 12.—Drainage ditches on flat, poorly drained bottom land.

Grassed waterways are needed for terrace outlets to provide safe disposal of excess water. They are also used with diversion terraces and in natural drains.

Waterways can be maintained by one or more of the following: (1) Fencing if practical, (2) mowing or spraying to control weeds, (3) lifting farm implements when crossing waterways, (4) not using waterways for farm roads, (5) control of grazing, (6) fertilizing as needed, and (7) not performing farming operations, including plowing, too near the waterway.

Drainage.—There are approximately 35,000 acres of poorly drained soils in the county, mainly on bottom lands that need surface drainage (fig. 12). All these soils are potentially good for crops or pasture. The principal deterrent to drainage is frequent flooding by major streams during years of high rainfall.

A good drainage system is difficult to install and maintain, but the economic returns can be greater for building a drainage system than for any other conservation practice. Technical assistance for the planning, layout, and supervising of construction for drainage systems is available to farmers at the local office of the Soil Conservation Service.

General management of soils for tame pasture

Approximately 22 percent of the acreage in Rogers County is used for tame pasture. Most pastures are on good fertile soils that are suitable for cultivation. The general trend in the county has been to convert cropland to pasture. Tame pasture crops provide an excellent protective cover for these soils.

A good pasture that includes grasses and legumes and is under a high level of management produces from 175 to 300 pounds of gain on beef animals per acre in a growing season. The predicted average annual gains of beef for tame pastures on adapted soils of the county are listed in table 2.

A basic perennial grass or legume is the foundation for a good tame pasture. When a pasture is planned, it is necessary to consider (1) the needs of the land, (2) the needs of the farmer, (3) the season when additional forage is needed, (4) the grass or legume best adapted to the soil, and (5) the grazing requirements. A good tame pasture contains 60 to 80 percent grasses and 20 to 40 percent legumes.

To maintain tame pasture at a high level of production, use the following management practices: (1) Timely ap-

plications of fertilizer in amounts based on current recommendations, (2) control of weeds and brush by use of foliage sprays or by mowing, (3) an adequate supply of water, and (4) regulation of grazing so that a vigorous stand of grasses and legumes is maintained.

Adapted and recommended species of pasture plants for Rogers County are bermudagrass, fescue, weeping lovegrass, bromegrass, annual lespedeza, sericea lespedeza, alsike clover, ladino clover, white clover, yellow hop clover, vetch, and sweetclover.

Capability Grouping of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that restrict their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIe–2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use.
- Capability unit I–1.—Deep, loamy, nearly level, moderately well-drained soils in upland prairies.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe–1.—Deep, loamy, gently sloping, moderately well drained soils in upland prairies.
  - Capability unit IIe–2.—Deep, loamy, gently sloping, well-drained soils in upland prairies.
  - Capability unit IIe–3.—Deep, loamy gently sloping, well-drained soil in forested upland.
- Subclass IIs. Soils that have moderate limitations of moisture capacity or a claypan.
  - Capability unit IIs–1.—Deep, loamy, grayish-colored, nearly level claypan soils in upland prairies.
  - Capability unit IIs–2.—Deep, clayey, nearly level, dark-colored, claypan soils in upland prairies.
- Subclass IIw. Soils that have moderate limitations because of excess water.
  - Capability unit IIw–1.—Deep, loamy, dark-colored, level, moderately well-drained soils on flood plains.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils subject to severe erosion if they are tilled and not protected.
  - Capability unit IIIe–1.—Deep, loamy, moderately sloping, well-drained soils in upland prairies.
  - Capability unit IIIe–2.—Deep, clayey, dark-colored, moderately sloping, moderately well drained soils in upland prairies.
  - Capability unit IIIe–3.—Deep, loamy, moderately sloping, well-drained soils in forested uplands.
  - Capability unit IIIe–4.—Deep or moderately deep, loamy, gently or moderately sloping, eroded, well-drained soils in upland prairies.
  - Capability unit IIIe–5.—Moderately deep, loamy, gently sloping, well-drained soils in upland prairies.
- Subclass IIIw. Soils that have severe limitations because of excess water.
  - Capability unit IIIw–1.—Deep, clayey, level, poorly drained soils on bottom lands.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils subject to very severe erosion if they are tilled and not protected.

Capability unit IVe–1.—Deep and shallow, loamy, gently or moderately sloping, well-drained soils in upland prairies.

Capability unit IVe–2.—Deep and shallow, loamy, gently or moderately sloping, well-drained forested soils in uplands.

Subclass IVs. Soils that have very severe limitations of stoniness, claypan, or other soil features.

Capability unit IVs–1.—Deep, loamy, gray-colored, level, poorly drained claypan soils in upland prairies.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.

Capability unit Vw–1.—Frequently flooded, deep, loamy, irregularly sloping soils on bottom lands.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe. Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIe–1.—Severely eroded, deep soils in upland prairies and on breaks along drainageways of prairies.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIIe–1.—Deep, steep, irregularly sloping mine dumps from strip mining.

Subclass VIIs. Soils very severely limited by moisture capacity, stones, or other soil features.

Capability unit VIIs–1.—Shallow, stony, loamy, moderately sloping to very steep, somewhat excessively drained forested soils in uplands.

Capability unit VIIs–2.—Very shallow, stony, loamy, moderately sloping or very steep, well-drained or excessively drained soils from sandstone and shale in upland prairies.

Capability unit VIIs–3.—Very shallow, stony, loamy, dark-colored, gently sloping or moderately steep soils from limestone in upland prairies.

Capability unit VIIs–4.—Very shallow, stony, very steep, excessively drained forested soils in uplands.

Class VIII. Soils and landforms that, without major reclamation, have limitations that preclude their use for commercial production of plants and that restrict their use to recreation, water supply, wildlife, and esthetic purposes.

Subclass VIIIs. Rock or soil materials that have little potential for production of vegetation.

Capability unit VIIIs–1.—Borrow pits and Gravel pits.

Management by Capability Units

In the following pages the capability units of Rogers County are described, the soils in each unit are listed, and some management practices are discussed.

All soils in one capability unit have about the same limitations, have similar risks of damage, and need about the same kind of management, though they may have formed from different kinds of parent material and in different ways.

CAPABILITY UNIT I–1

In this capability unit are deep, loamy, dark-colored or reddish soils that are nearly level and moderately well drained. The soils are in the upland prairies. They are—

Newtonia silt loam, 0 to 1 percent slopes.
Okemah silty clay loam, 0 to 1 percent slopes.

These soils are very productive and are used mainly for cultivated crops and tame pasture. The main problems are the maintenance of soil fertility and structure. Under good management, these soils are suited to intensive use for all adapted crops.

The principal crops grown are corn, small grain, grain sorghum, soybeans, and tame pasture. If most of the residue is returned to the soil, a suitable rotation is 2 years of small grain followed by 3 years of corn or grain sorghum. Corn, grain sorghum, soybeans, small grain, and other crops producing large amounts of forage can be grown continuously if all crop residue is returned to the soil.

Generally, natural fertility is high, but when the soils have been depleted by intensive farming, they should be tested and fertilizer applied according to the needs indicated by the tests. Minimum tillage and growing of cover crops or soil-improving crops to provide large amounts of residue are ways of maintaining good soil structure.

CAPABILITY UNIT IIe–1

In this capability unit are deep, loamy, dark-colored soils that are gently sloping and moderately well drained. These are soils in upland prairies. They are—

Okemah silty clay loam, 1 to 3 percent slopes.
Summit silty clay loam, 1 to 3 percent slopes.

These soils are productive and are used mainly for cultivated crops and tame pasture. Control of runoff, protection from erosion, and maintenance of soil structure and fertility are the main problems of management.

The principal crops are corn, small grain, sorghum, alfalfa, soybeans, and tame pasture. Small grain can be grown continuously if it is managed for high production and all residue is returned to the soils. Cropping also can be continuous if a small grain and a legume are grown together.

A good cropping sequence is corn, grain sorghum or a similar row crop grown for 3 years, and then a small grain, vetch, lespedeza, or some other close-growing crop for 2 years. Corn or grain sorghum can be grown continuously if only the grain is harvested and the residue is returned to the soil.

Terraces are needed if these soils are used for row crops. Drainageways and terrace outlets should be seeded or sodded with perennial plants. All tillage should be on the contour.

These soils generally have high natural fertility, but this may have been depleted by intensive farming. For this reason, soil tests should be made and fertilizer and lime applied according to the results of the tests. Good soil structure can be maintained by using minimum tillage, growing soil-improving crops, and returning large amounts of crop residue to the soils. Structure can be damaged by grazing or cultivating these soils when they are wet, as the surface soil then packs easily or a plowpan readily forms. Varying the depth of tillage and growing deep-rooted legumes are practices that help to eliminate a plowpan.

CAPABILITY UNIT IIe-2

In this capability unit are deep, loamy, dark- or reddish-colored soils that are gently sloping and well drained. They are in upland prairies. They are—

Choteau silt loam, 1 to 3 percent slopes.
Dennis silt loam, 1 to 3 percent slopes.
Newtonia silt loam, 1 to 3 percent slopes.
Riverton loam, 1 to 3 percent slopes.

These soils are moderately fertile and are used largely for cultivated crops and tame pasture. The common problems are protection of the soils from erosion by controlling runoff and the maintenance of soil structure and fertility.

The crops commonly grown on these soils are corn, small grain, sorghum, soybeans, alfalfa, and tame pasture. A good cropping system is corn, grain sorghum, or another row crop for 3 years and a sown crop, such as small grain, vetch, or lespedeza, for 2 years. Grain sorghum or corn can be grown continuously if only the grain is harvested and enough residue is returned to the soil. Small grain grown continuously is also a good cropping system if the small grain is managed for high production and the residue is returned to the soil. Another satisfactory cropping system consists of a mixture of small grain and a legume grown continuously.

If the soils in this capability unit are used for row crops, terraces are needed. Drainageways and terrace outlets should be seeded or sodded to perennial plants. All tillage should be on the contour.

The natural fertility is generally high. In places where this fertility has been depleted by intensive farming, the soils should be tested, and fertilizer and lime should be applied according to the needs indicated by the tests.

Minimum tillage and growing of soil-improving crops and crops that produce large amounts of residue are ways of maintaining good soil structure. The soils should not be grazed or tilled when wet; otherwise, the surface may be compacted and a plowpan formed. Varying the depth of tillage and using deep-rooted legumes help to eliminate a plowpan.

CAPABILITY UNIT IIe-3

Linker fine sandy loam, 1 to 3 percent slopes, is the only soil in this capability unit. It is a deep, loamy, gently sloping soil that is well drained. It is in the forested uplands.

This soil is low in fertility and is used mainly for tame pasture. Protection from moderate erosion and maintenance of structure and fertility are the main problems.

Crops commonly grown on this soil are grain sorghum, oats, rye, sericea lespedeza, and tame pasture. A good cropping system consists of corn and grain sorghum for 3 years and a sown crop such as rye, oats, or lespedeza for 2 years. Another good cropping system consists of a mixture of either oats or rye and a legume grown continuously. Corn or grain sorghum can be used continuously if only the grain is harvested and the residue is returned to the soil.

Terraces are needed if the soil is used for row crops. Drainageways and terrace outlets should be seeded or sodded to perennial plants. All tillage should be on the contour.

Generally, natural fertility is high, but where the soil has been depleted by intensive farming, it should be tested, and fertilizer should be applied according to the needs indicated by the tests. Minimum tillage and growing of cover crops or soil-improving crops to provide large amounts of residue are ways of maintaining good soil structure. Structure can be damaged by grazing or cultivating this soil when it is wet, as the surface layer then packs or a plowpan readily forms. Varying the depth of tillage and growing deep-rooted legumes are practices that help to eliminate a plowpan.

CAPABILITY UNIT IIs-1

In this capability unit are deep, loamy, grayish-colored claypan soils that are nearly level. They are in the upland prairies. They are—

Parsons silt loam, 0 to 1 percent slopes.
Taloka silt loam, 0 to 1 percent slopes.

Most areas of these soils are cropped to small grain, grain sorghum, or tame pasture. Problems of management are the maintenance of fertility and structure, formation of plowpans, and slow permeability. Poor surface drainage is a problem in some areas.

The crops commonly grown on these soils are small grain, grain sorghum, corn, and soybeans. A suitable cropping system is wheat or some other small grain grown continuously if the residue is returned to the soil. Grain sorghum or a similar row crop for 3 years, followed by a small grain-legume mixture for 2 years, is also a good cropping system. Tame pasture, however, is a better use for these soils.

In most places terraces are not needed on these soils. Direction of rows toward outlets for drainage is beneficial for most crops.

Crop residue should be returned to these soils regularly to help maintain the content of organic matter, to improve soil structure, and to increase the intake of water. Structure can be damaged by tilling and grazing these soils when they are wet, as the surface soil then packs easily or a plowpan forms. Varying the depth of tillage helps to eliminate a plowpan.

These soils should be tested, and fertilizer and lime should be applied according to the needs indicated by the tests.

CAPABILITY UNIT IIs-2

The soils in this capability unit, Woodson and Summit soils, 0 to 1 percent slopes, are mapped together as an undifferentiated group. They are deep, clayey, slowly permeable, nearly level soils that are dark colored and are in the upland prairies.

These soils are difficult to cultivate, and yields are low. The main problems of management result from the tendency of these soils to puddle when wet and to crust when dry, the dense claypan subsoil, and droughtiness.

The crops commonly grown on these soils are small grain, grain sorghum, and tame pasture. A good cropping system consists of a sown crop used for tame pasture or a small grain-legume mixture grown continuously. If nearly all of the crop residue is returned to the soil, 3 years of grain sorghum followed by 2 years of small grain is a good rotation.

In most places terraces are not needed on these soils. Most crops benefit if rows are directed toward outlets for drainage.

Crop residue should be returned to these soils regularly to help maintain the content of organic matter, to improve soil structure, and to increase the intake of water. Structure can be damaged by grazing these soils when they are wet, as the surface soil then packs easily or a plowpan forms. Varying the depth of tillage helps to prevent the formation of a plowpan.

These soils should be tested, and fertilizer and lime should be applied according to the needs indicated by the tests.

CAPABILITY UNIT IIw–1

In this capability unit are deep, loamy, moderately well drained, dark-colored soils on bottom lands that are subject to seasonal overflow. The soils are—

Verdigris silt loam.
Verdigris clay loam.

The soils are fertile and are readily penetrated by plant roots and water. They are used mainly for cultivated crops and tame pasture. Fescue and other plants commonly seeded in tame pastures are well adapted to the soils in this unit (fig. 13) and occupy a large acreage.

Most irrigation in the county is on soils of this unit. Irrigation water is pumped largely from flowing streams.

The principal problems in managing these soils are the maintenance of fertility and soil structure and protection from flooding. Drainage of some small areas is beneficial. Loss of crops from flooding can be expected during extremely wet seasons. If these soils are protected from flooding, they can be placed in capability unit I–1 and farmed more intensively.

The principal crops grown on these soils are corn, alfalfa, soybeans, sorghum, small grain, pecans, and tame pasture. A suitable rotation consists of 3 or 4 years of alfalfa followed by 2 years of corn or grain sorghum. A rotation consisting of 2 years of small grain and 4 years of corn is satisfactory if all the residue from these crops is returned to the soil. Corn, grain sorghum, soybeans, small grain, and other crops producing large amounts of forage can be grown continuously if the residue is returned to the soil.

In many places native pecan trees that were a part of the hardwood forest have been left as pecan groves. The trees are spaced from 40 to 80 feet or more apart. These groves are generally used for tame pasture as well as for growing pecans.

Generally, natural fertility is high. Where the soils have been depleted by intensive farming, however, they should be tested and fertilizer applied according to indicated needs.

Minimum tillage and growing soil-improving crops to produce large amounts of residue are ways of maintaining good soil structure. The soils should not be tilled or grazed when wet. Such practices cause a plowpan to form or the surface to compact. If the depth of tillage is varied and alfalfa and sericea lespedeza and other deep-rooted crops are grown, plowpans usually can be prevented or eliminated.

CAPABILITY UNIT IIIe–1

In this capability unit are deep, loamy, dark- or reddish-colored soils that are moderately sloping and well drained. The soils are on the upland prairies. They are—

Dennis-Bates complex, 2 to 5 percent slopes.
Dennis silt loam, 3 to 5 percent slopes.
Riverton gravelly loam, 3 to 5 percent slopes.

The Riverton gravelly loam is gravelly in the surface layer and has beds of gravel at lower depths.

The soils in this capability unit are moderately productive and are used extensively for tame pasture and cultivated crops. The protection of the soils from severe erosion, the maintenance of structure and fertility, and the prevention of a plowpan are the main problems in management.

The crops commonly grown on these soils are small grain, corn, soybeans, sorghum, and tame pasture. A good cropping system consists of corn or grain sorghum for 2 years and a small grain and a legume for 1 year. Small grain can be grown year after year, if it is managed for high production and all residue is returned to the soil.

Regular use of large amounts of crop residue and the use of a good cropping system help to maintain the content of organic matter, to improve soil structure, to increase intake of water, and to control erosion. Tillage and grazing should be timed to prevent excessive compaction of the soils. Varying the depth of tillage helps to prevent the formation of a plowpan or to eliminate an existing plowpan.

Terraces and contour farming prevent the concentration of water and are needed if row crops are grown on these soils. Terraces are not needed, however, for close-growing grasses and legumes that are used as soil-improving crops. Perennial vegetation should be established in drainageways and terrace outlets.

Generally, the natural fertility is high. Where the soils have been depleted by intensive farming, however, they should be tested, and fertilizer applied according to needs indicated by the tests.

CAPABILITY UNIT IIIe–2

Summit silty clay loam, 3 to 5 percent slopes, is the only soil in this capability unit. It is a deep, clayey, dark-colored soil. It is moderately sloping and occurs on moderately well drained upland prairies.

This soil is very productive and is used mainly for cultivated crops and tame pasture. Protection from severe erosion and maintenance of structure and fertility are the main problems of management.

Crops that grow well on the soil are small grain, sorghum, corn, and tame pasture. A good cropping system consists of grain sorghum or corn for 2 years followed by small grain for 1 year. Crop residue should be returned to the soil. Small grain can be grown continuously if it is managed for high production and all residue is returned to the soil.

The use of a good cropping system and regular use of large amounts of crop residue help to maintain the content of organic matter, to improve soil structure, to increase the intake of water, and to control erosion. Structure can be damaged by grazing or cultivating these soils when

Figure 13.—Pasture of fescue and ladino clover on Verdigris clay loam.

they are wet, as the surface soil then packs easily or a plowpan forms. Varying the depth of tillage helps to eliminate a plowpan.

Terraces and contour farming prevent the concentration of water and are needed if row crops are grown. Close-growing grasses and legumes can be grown as soil-improving crops without terraces. Drainageways and terrace outlets should be provided, where needed, and should be seeded or sodded to perennial plants.

Generally, natural fertility is high, but where the soils have been depleted by intensive farming, they should be tested and fertilizer applied according to the needs indicated by the tests.

CAPABILITY UNIT IIIe-3

Linker fine sandy loam, 3 to 5 percent slopes, is the only soil in this capability unit. It is a deep, loamy, moderately sloping, well-drained soil. It occurs in the forested uplands.

This soil is not very productive and is used mainly for tame pasture. The main problems of management are protection from severe erosion, maintenance of fertility and structure, and prevention of a plowpan.

Tame pasture, grain sorghum, forage sorghum, corn, and sericea lespedeza are commonly grown on this soil. Corn or grain sorghum can be grown continuously if all residue is returned to the soil.

The use of a good cropping system and regular use of large amounts of crop residue help to maintain the content of organic matter, to improve soil structure, to increase the intake of water, and to control erosion. Structure can be damaged by grazing or cultivating these soils when they are wet, as the surface soil then packs easily or a plowpan forms. Varying the depth of tillage helps to eliminate a plowpan.

Terraces and contour farming prevent the concentration of water and are needed if row crops are grown. Close-growing grasses and legumes can be grown as soil-improving crops without terraces. Drainageways and terrace outlets should be provided, where needed, and should be seeded or sodded to perennial plants.

Generally, the natural fertility is high, but where the soil has been depleted by intensive farming, it should be tested and fertilizer applied according to the needs indicated by the tests.

CAPABILITY UNIT IIIe-4

This capability unit consists of deep or moderately deep, loamy, gently sloping or moderately sloping, eroded soils in the uplands. They are—

Bates and Dennis soils, 3 to 5 percent slopes, eroded.
Okemah silty clay loam, 1 to 3 percent slopes, eroded.
Riverton gravelly loam, 3 to 5 percent slopes, eroded.
Summit silty clay loam, 1 to 5 percent slopes, eroded.

These soils are best suited to tame pasture or hay crops and are used largely for them. Protection from severe erosion and maintenance of soil structure and fertility are the main problems of management.

Some of the crops better suited to these soils are tame pasture, grain sorghum, sericea lespedeza, and small grain. A good cropping sequence is 2 years of grain sorghum followed by 3 years of small grain. Crop residue should be returned to the soil. If it is managed for high production and all residue is returned to the soil, small grain can also be grown continuously.

Terraces and contour farming are needed if crops are grown that require a clean seedbed or cultivation. Where needed, drainageways and terrace outlets should be provided and seeded or sodded to perennial plants.

The use of a good cropping system and regular use of large amounts of crop residue help to maintain the organic matter, to improve soil structure, to increase the intake of water, and to control erosion.

The fertility of these soils has been depleted. The soils should be tested to determine the kind and amount of fertilizer needed.

CAPABILITY UNIT IIIe-5

Claremore silt loam, 0 to 3 percent slopes, is the only soil in this capability unit. It is a moderately deep, reddish-brown, gently sloping soil that is well drained. It is in upland prairies and is underlain by limestone.

This soil is moderately fertile and is used mainly for cultivated crops and tame pasture. The problems of management are protection from erosion and maintenance of structure and fertility.

The crops commonly grown are small grain, grain sorghum, soybeans, corn, and tame pasture. Small grain grown continuously is a good cropping sequence if it is managed for high production and the residue is returned to the soil. A small grain-legume mixture can also be grown continuously. Most tame pastures do well on this soil; they can be grown continuously or in a rotation.

Terraces are difficult to build in a few areas because limestone bedrock is near the surface. Erosion can be partly controlled by contour tillage, by use of sown or close-growing crops, and by use of cover crops.

The use of a good cropping system and regular use of large amounts of crop residue help to maintain the content of organic matter, to improve soil structure, to increase the intake of water, and to control erosion. Tillage and grazing should be timed to prevent excessive compaction of the soil. Tillage at variable depths helps to eliminate a plowpan.

Terraces and contour farming prevent the concentration of water and are needed if row crops are grown. Terraces, however, are not needed if close-growing grasses and legumes are grown as soil-improving crops. Drainageways and terrace outlets should be provided and should be seeded or sodded to perennial plants.

Generally, the natural fertility is high, but where this soil has been depleted by intensive farming, it should be tested and fertilizer and lime applied according to the needs indicated by the tests.

CAPABILITY UNIT IIIw-1

Osage clay is the only soil in this capability unit. It is a deep, clayey, dark-colored, nearly level soil. It is on bottom lands. Slopes range from 0 to 1 percent.

This soil is difficult to work and generally is poorly drained. In most areas it has not been cleared. A good stand of native pecan trees are in most wooded areas (fig. 14). Unless adequately drained, cultivated areas usually produce low yields. Poor drainage, occasional floods, and the tendency of the soil to run together when wet and to crust when dry are the main problems.

The principal crops grown are pecans, small grain, grain sorghum, and tame pasture. When it is adequately drained, this soil produces fair yields of wheat, corn, barley, and grain sorghum. Small grain can be grown continuously if it is managed for high production and the residue is returned to the soil. Sown crops for tame pasture or hay can also be grown continuously (fig. 15).

Regular use of crop residue helps to maintain the content of organic matter, to improve soil structure, and to increase the intake of water. The natural fertility of this soil generally is moderately low, and aeration is poor. The soil should be tested, and fertilizer and lime should be applied according to the results of the tests.

This soil should not be tilled or grazed when it is wet. A drainage system that includes direction of rows to drainage outlets is beneficial for most crops.

The use of a good cropping system and the return of large amounts of crop residue to the soil help to maintain the content of organic matter, to improve soil structure, to increase the intake of water, and to control erosion. Tillage and grazing when the soil is wet cause excessive

Figure 14.—**Pecan trees on Osage clay. Other timber was cleared, and pecan trees were left.**

Figure 15.—**Field of Osage clay recently cleared, drained, and planted to tame pasture. Drainage ditch runs along wooded area.**

compaction. Varying the depth of tillage helps to eliminate a plowpan.

The soil generally has high natural fertility, but this may have been depleted by intensive farming. Consequently, the soil should be tested and fertilizer applied according to needs indicated by the tests.

CAPABILITY UNIT IVe-1

The soils in this capability unit are mapped together as the Bates-Collinsville complex. This complex is made up of deep and shallow, loamy, gently sloping to moderately sloping soils that are well drained and are in upland prairies. Slopes range from 3 to 7 percent.

The soils of this unit produce low yields of most crops, and only a small percentage of the complex is cultivated. Shallowness to bedrock, protection from moderate erosion, and maintenance of soil structure and fertility are the main problems of management.

The crops commonly grown on this complex of soils are small grain, grain sorghum (drilled or sown), sericea lespedeza, and tame pasture. If it is managed for high production and the residue is returned to the soil, small grain grown continuously is a good cropping system. Continuous use for pasture, however, is the best and most commonly used cropping system.

In some areas terraces are difficult to construct because bedrock is near the surface. Erosion can be partly controlled by contour tillage, by close-growing crops, and by cover crops. If soil-depleting crops are included in the cropping system, terraces are needed. Regular use of crop residue and cover crops helps to maintain the content of organic matter, to improve soil structure, and to increase the intake of water.

Generally, the natural fertility is moderately high, but where the soils have been depleted by intensive farming, they should be tested and fertilizer and lime applied according to the needs indicated by the tests.

CAPABILITY UNIT IVe-2

The soils in this capability unit, Hector-Linker fine sandy loams, 1 to 5 percent slopes, are mapped together as a soil complex. The complex is made up of deep and shallow, loamy soils that are gently sloping to moderately sloping and are well drained. They are in forested uplands.

The soils in this complex produce low yields of most crops, and only a small part of the complex is cultivated.

The main management problems result from shallowness to bedrock, susceptibility to moderate erosion, and the difficulty of maintaining fertility.

The crops commonly grown on the soils of this complex are small grain, sudangrass, sericea lespedeza, Korean lespedeza, and vetch. If fertilizer and lime are applied as needed, pasture grown continuously is a good cropping system. Small grain can also be grown continuously if it is managed for high production and the residue is returned to the soil.

Terraces are difficult to build on the soils in this complex because bedrock is near the surface in places. Erosion can be partly controlled by contour tillage, by use of close-growing crops, and by use of cover crops. If soil-depleting crops are used in the cropping system, terraces are needed.

Regular use of crop residue and cover crops help to maintain the content of organic matter, to improve soil structure, and to increase the intake of water.

Generally, natural fertility is moderately high, but when the soils have been depleted by intensive farming, they should be tested and fertilizer and lime applied according to the needs indicated by the tests.

CAPABILITY UNIT IVs-1

Dwight silt loam, 0 to 1 percent slopes, is the only soil in this capability unit. It is a deep, loamy, grayish-colored soil that is level, is poorly drained, and has a claypan subsoil. It is in the upland prairies.

This soil has very low fertility, and very few areas of it are used for cultivated crops. Most of the acreage is in native grasses. The claypan subsoil, poor drainage, low fertility, and droughtiness cause the main management problems.

Crops grown successfully on this soil are fall-sown small grain and tame pasture. The soil is used mainly for bermudagrass pasture and native range.

Wheat or another small grain can be grown continuously and will produce satisfactory yields if the straw is returned to the soil. If the weight of straw exceeds 2,000 pounds per acre, 20 to 30 pounds of available nitrogen per acre is needed. The amount of straw returned should not be allowed to fall below 3,000 pounds per acre oftener than 2 successive years.

CAPABILITY UNIT Vw-1

The soils in this capability unit—Verdigris soils, frequently flooded—are mapped together as an undifferentiated group. They are deep, irregularly sloping soils of variable texture. Slopes range from 0 to 15 percent. Little of the acreage has been cleared for cultivation. Frequent floods and irregular slopes are the main management problems.

The soils in this group are not suitable for cultivation. They can be used for grasses, post lots, pecan orchards, and hardwood trees, or for wildlife food and cover. Tame pasture produces good yields where it can be established and where it is included with pastures on other soils.

The management of the soils of this group for range is described in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIe-1

In this capability unit are severely eroded, deep, loamy soils in upland prairies and on drainage breaks along intermittent streams. Drainage ranges from imperfect to somewhat excessive. The soils of this unit produce low yields, and only a small part of the acreage is cultivated. Irregular slopes and severe erosion are the main problems of management. The soils are—

Breaks-Alluvial land complex.
Eroded loamy land.

These soils are unsuited to cultivated crops. They can be used for tame pastures, native grasses, or wildlife food and cover. Establishing and managing tame pasture on these soils depends largely on whether the surrounding soils are used for pasture. Pasture on these soils would be managed like those on the surrounding soils. Sloping of banks, mulching, and building diversion terraces are practices that can be used in establishing and managing tame pasture.

The management of soils of this capability unit for range is described in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIIe-1

Strip mines is the only mapping unit in this capability unit. It consists of deep, steep, irregularly sloping dumps left from the strip mining of coal. The dumps are made up largely of shale mixed with large sandstone and limestone boulders. Runoff is rapid.

The main problems of management result from the steep and irregular slopes, large boulders, droughtiness, and the susceptibility of this land type to moderate erosion.

This land type is suited to native grasses, tame pastures, post lots, and wildlife food and cover.

Tame pasture plants that can be established on most areas of this soil are sweetclover, lespedeza, fescue, and bermudagrass (fig. 16). Management practices needed for pasture on dumps in their original condition are equally limited to grazing control and fire prevention. In areas where the dumps are levelled, the response to pasture crops is similar to that of deep soils in the uplands.

The management of this land type for range is described in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIIs-1

Hector stony sandy loam is the only soil in this capability unit. It is a shallow, stony, loamy soil that is moderately sloping to steep and somewhat excessively drained. This soil formed in uplands under trees.

Because it is steep, shallow, stony, and susceptible to moderate erosion, this soil is not suitable for cultivation. It is best suited to production of native grasses or food and cover for wildlife. Tame pastures can be grown in the gently sloping areas. The practices needed to establish and manage pasture vary according to the depth and stoniness of the soil and to the intensity of use. Adapted pasture plants are bermudagrass, lespedeza, and yellow hop clover. The management of this soil for other uses is described in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIIs-2

Collinsville stony loam is the only soil in this capability unit. It is a dark-colored, very shallow, stony, loamy soil of the upland prairies. This moderately sloping to steep, somewhat excessively drained soil formed from sandstone and shale. Slopes range from 3 to 20 percent.

Figure 16.—Sweetclover that was seeded by airplane on strip mines.

This soil is not suitable for cultivation. Steepness, shallowness, stoniness, and susceptibility to moderate erosion are the main problems of management.

This soil is best suited to native grasses. Its management is described in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIIs-3

This capability unit consists of an undifferentiated group, Sogn soils. Slopes range from 3 to 20 percent. These are very shallow, dark-colored, stony, loamy soils of the upland prairies. They are gently sloping to moderately steep, excessively drained soils that formed from limestone. The main problems of management are caused by the shallowness of these soils to bedrock, their stoniness, and their susceptibility to moderate erosion.

The soils of this unit are best suited to native grasses. Their management for range is described in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIIs-4

This capability unit consists of only one mapping unit, Rough stony land. This land is very shallow, stony, and very steep. Slopes range from 20 to 35 percent. Rough stony land is excessively drained, is forested, and is in the uplands. It is not suited to cultivated crops. The susceptibility of this land type to severe erosion is the main problem of management.

This land is suited to native grasses and to wildlife food and cover. Management for range is discussed in the subsection "Use of Soils for Range."

CAPABILITY UNIT VIIIs-1

This capability unit consists of areas where the soil has been removed and where gravel has been excavated for use in construction. These areas are mapped as land types. They are—

Borrow pits.
Gravel pits.

These pits contain water most of the time. Areas occupied by these pits have limited use for the commercial production of plants. They can be used as a source of water, for fish and other kinds of wildlife, and for recreation.

Predicted Yields [2]

Predicted long-time average yields for important crops and gains in beef per acre in Rogers County are listed in table 2 under two levels of management.

In columns A are predicted yields for soils under customary management, or that management followed by a large number of farmers in the county. This management normally includes (1) proper rates of seeding, proper dates of planting, and efficient methods of harvesting; (2) sufficient control of weeds, insects, and diseases to insure good plant growth; (3) terraces and contour farming where necessary; and (4) use of lime and fertilizer in small amounts.

In columns B are predicted yields for soils under improved management. This management includes the first three practices listed under customary management, plus (1) use of lime and fertilizer in amounts indicated by soil tests; (2) the use of adapted, improved varieties; (3) surface drainage where required; (4) residue management and those tillage methods that prevent erosion, maintain structure, increase infiltration, and enhance seedling emergence; (5) a cropping sequence fitted to the operator's goals and the specific needs of soils, and (6) tame pasture management that includes uniform grazing, deferred or rotation grazing, brush control, and renovation.

Yields are not reported for soils that are normally considered unsuitable as cropland. Crop failures (zero yields) are included in the yield estimates. Yields at specific management levels were estimated by the soil scientists making the soil survey in the county through consultations with farmers and by observation during the progress of the survey. These estimates were further corroborated by personnel of Oklahoma State University, from research information applicable to the crops and soils of Rogers County.

Use of Soils for Range [3]

About half of the land in Rogers County is used as rangeland. This rangeland includes a wide variety of soils. At one extreme are high-producing, deep, loamy, prairie soils, and at the other are the low-producing soils on stony, steep, savannah breaks.

The prairies originally produced a mixture of tall grasses composed principally of big bluestem, little bluestem, switchgrass, and indiangrass, and numerous native perennial legumes and other forbs. The savannahs had an open stand of post oak and blackjack oak and an understory of tall grasses. Some fields that formerly were cultivated have been returned to rangeland by reseeding with a mixture of native grasses or by natural reseeding.

The county has 52 ranch units that contain 59,687 acres and average about 1,148 acres each. These ranch units represent about 25 percent of the total rangeland. Ranches totaling 155,000 acres are operated in smaller units. The rangeland operated in the larger units is generally in better condition than that in the smaller units. Many pastures on the smaller farms, however, are in excellent condition. About 21,000 acres of native grasses is in meadows.

The production of cattle is the chief livestock operation in the county. The cow-and-calf plan is most used. Under this plan, spring calves are sold late in summer or early in fall. Calves that grade good or better are sold directly to packers; those of lower grade are sold as stockers or feeders. The number sold as stockers and feeders is the largest.

In the following pages, range sites and condition classes are discussed. Also, the individual range sites are described, and the soils in each are listed. The kinds of plants on each site are listed in table 3, and the yields of herbage produced on each site are estimated and listed in table 4 (page 35). Finally, some practices of range management that apply to all sites are discussed.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that have different potentials for producing native, or climax, plants. Sites retain their potential capacity to reproduce the original plant community unless the soils are severely altered physically. Nature constantly restores the kind and amount of vegetation that originally grew on the site. On the better rangelands, the present plant community is very close to the original one.

The soils in any one range site produce about the same kind and amount of climax vegetation. *Climax vegetation* is the combination of plants that originally grew on a site. It is generally the most suitable and the most productive vegetation for the site. In addition, most plants in the climax vegetation are palatable and nutritious for grazing animals.

Different plants respond in different ways to grazing. According to their response to grazing, they are called *decreasers*, *increasers*, and *invaders*. The common decreasers, increasers, and invaders for three groups of range sites are listed in table 3.

Decreasers are perennials that are most palatable to livestock. Under moderately heavy to heavy grazing, they decrease in number. The percentage of decreasers is estimated in determining the range condition class.

Increasers are plants that are less palatable to livestock and normally increase as the decreasers decline. Increasers, in turn, may decrease as moderately heavy to heavy grazing is continued. They are generally, though not always, the shorter, less productive, subdominant plants. Their forage value ranges from high to low, but those of low value tend to increase more rapidly under grazing. A limited percentage of increases (that which is normal in a relict area in excellent condition) can be

[2] By ROY SMITH, assistant professor, Department of Agronomy, Oklahoma State University.

[3] By H. N. STIDHAM and ALLEN A. MOSS, range conservationists, Soil Conservation Service.

TABLE 2.—*Predicted average acre yields of principal crops and annual gains in beef per acre of pasture under two levels of management*

Yields in columns A are expected under customary management; yields in columns B are expected under improved management. Absence of yield indicates crop is seldom grown on the soil specified, or is not suited to it, or the soil is not arable]

Soil	Capability unit	Wheat		Oats [1]		Corn		Grain sorghum		Alfalfa		Soybeans		Barley		Bermudagrass pasture	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lbs. of beef* [2]	*Lbs. of beef* [2]
Bates-Collinsville complex	IVe–1	13	18	20	30	----	----	20	28	----	----	----	----	18	28	75	175
Bates and Dennis soils, 3 to 5 percent slopes, eroded	IIIe–4	13	20	22	32	----	----	20	30	----	----	----	----	20	30	100	200
Breaks-Alluvial land complex	VIe–1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	75	150
Choteau silt loam, 1 to 3 percent slopes	IIe–2	20	30	32	48	30	45	30	45	2.0	3.0	12	20	32	45	175	300
Claremore silt loam, 0 to 3 percent slopes	IIIe–5	14	22	23	35	----	----	20	30	----	----	----	----	22	34	100	200
Dennis-Bates complex, 2 to 5 percent slopes	IIIe–1	15	20	23	39	23	34	24	34	----	----	12	19	24	34	125	225
Dennis silt loam, 1 to 3 percent slopes	IIe–2	20	28	30	44	26	40	30	43	1.5	2.5	14	20	30	42	175	275
Dennis silt loam, 3 to 5 percent slopes	IIIe–1	17	25	20	38	22	35	26	38	----	----	10	16	26	36	125	225
Dwight silt loam, 0 to 1 percent slopes	IVs–1	6	10	14	24	----	----	----	----	----	----	----	----	10	20	----	----
Eroded loamy land	VIe–1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	60	150
Hector-Linker fine sandy loams, 1 to 5 percent slopes	IVe–2	----	----	15	25	----	----	12	20	----	----	----	----	15	24	75	150
Linker fine sandy loam, 1 to 3 percent slopes	IIe–3	----	----	15	25	16	24	18	30	----	----	----	----	20	34	150	250
Linker fine sandy loam, 3 to 5 percent slopes	IIIe–3	----	----	12	23	12	18	16	26	----	----	----	----	18	30	100	200
Newtonia silt loam, 0 to 1 percent slopes	I–1	20	28	34	46	32	44	34	46	2.3	3.3	16	22	32	45	200	300
Newtonia silt loam, 1 to 3 percent slopes	IIe–2	18	26	32	44	28	40	30	42	1.7	2.5	14	20	30	42	175	275
Okemah silty clay loam, 0 to 1 percent slopes	I–1	22	30	36	48	28	38	32	44	2.0	3.0	18	24	32	44	200	300
Okemah silty clay loam, 1 to 3 percent slopes	IIe–1	20	28	34	46	25	34	28	40	2.0	2.8	14	20	30	42	175	275
Okemah silty clay loam, 1 to 3 percent slopes, eroded	IIIe–4	15	22	26	38	18	25	20	32	----	----	10	15	24	36	100	200
Osage clay	IIIw–1	12	15	22	32	18	28	26	36	----	----	----	----	20	30	100	200
Parsons silt loam, 0 to 1 percent slopes	IIs–1	17	27	26	40	18	30	24	35	----	----	8	14	22	35	75	175
Riverton loam, 1 to 3 percent slopes	IIe–2	20	29	32	46	32	44	32	44	2.0	2.8	14	22	32	42	175	275
Riverton gravelly loam, 3 to 5 percent slopes	IIIe–1	16	24	24	36	22	32	24	34	----	----	10	18	24	34	150	250
Riverton gravelly loam, 3 to 5 percent slopes, eroded	IIIe–4	12	20	18	28	----	----	28	26	----	----	----	----	17	27	100	200
Summit silty clay loam, 1 to 3 percent slopes	IIe–1	18	28	30	42	25	34	26	38	2.0	2.8	14	20	26	36	175	275
Summit silty clay loam, 3 to 5 percent slopes	IIIe–2	15	23	24	36	20	29	22	34	1.5	2.5	10	16	24	34	100	200
Summit silty clay loam, 1 to 5 percent slopes, eroded	IIIe–4	11	18	26	32	----	----	16	28	----	----	----	----	18	28	75	150
Taloka silt loam, 0 to 1 percent slopes	IIs–1	20	30	30	56	24	38	28	43	2.0	3.0	14	22	30	42	100	225
Verdigris silt loam	IIw–1	24	35	36	54	45	60	35	50	3.0	4.0	22	30	34	50	200	375
Verdigris clay loam	IIw–1	24	35	36	54	45	60	35	50	3.0	4.0	22	30	34	50	200	375
Woodson and Summit soils, 0 to 1 percent slopes	IIs–2	14	22	20	32	----	----	24	32	----	----	----	----	20	30	75	175

[1] If winter varieties are used exclusively, yield can be increased by approximately 25 percent.

[2] Number of pounds of gain produced by 1 acre on an animal 1 year old in a growing season.

added to the percentage of decreasers to determine the range condition class.

Invaders are plants that were not among those originally at the site. They are not restricted to plants imported to America, however, as they may be normal components of other range sites in the same general locality. Although many invaders are woody plants, they also include herbaceous perennials and annuals. Invaders are not counted in determining the range condition class.

Ranchers estimate range condition to determine the approximate deterioration of the range. The rating of a particular range site is always relative to a standard that has been established for that range site. This standard is the kind and amount of native vegetation that the site is capable of producing. Accordingly, range condition is expressed in terms of a range condition class that represents the degree to which the present vegetation has departed from the native, or climax, vegetation. There are four range condition classes—*excellent*, *good*, *fair*, and *poor*.

A range site is in *excellent* condition if 76 to 100 percent of the present vegetation is the same kind as that in the original stand or the site is producing near the maximum. There is sufficient cover to protect the soil from erosion

TABLE 3.—*Decreaser, increaser, and invader plants on three groups of range sites*

LOAMY PRAIRIE, CLAYPAN PRAIRIE, SHALLOW PRAIRIE, AND VERY SHALLOW RANGE SITES

Plants	Decreasers	Increasers	Invaders
Grasses	Big bluestem. Little bluestem. Indiangrass. Switchgrass. Eastern gamagrass.	Meadow dropseed. Tall dropseed. Sideoats grama. Scribner panicum. Longspike tridens. Purpletop. Sedges. Rushes.	Three-awn. Windmillgrass. Broomsedge. Silver bluestem. Annual brome. Buffalograss. Hairy tridens.
Legumes	Leadplant. Illinois bundleflower. Virginia tephrosia. Slender lespedeza. Roundhead lespedeza. Catsclaw sensitivebrier. Prairie acacia. Yellow neptunia.	Blue wild-indigo. Cream wild-indigo. Slimflower scurfpea.	Showy partridgepea. Deervetch. Trailing wildbean.
Forbs	Blacksamson. Compassplant. Tall gayfeather. Scaly gayfeather.	Dotted gayfeather. Heath aster. White aster. Drummond aster. Downy goldenrod. Dyersweed goldenrod. Tall goldenrod. Stiff goldenrod. Ashy sunflower. Sagewort.	Annual ragweed. Perennial ragweed. Tall ironweed. Bitter sneezeweed. Texas croton. Common yarrow. Annual broomweed.

SANDY SAVANNAH, SHALLOW SAVANNAH, AND SAVANNAH BREAKS RANGE SITES

Plants	Decreasers	Increasers	Invaders
Grasses	Big bluestem. Little bluestem. Indiangrass. Switchgrass. Canada wildrye. Virginia wildrye.	Purpletop. Tall dropseed. Scribner panicum. Perennial lovegrass. Muhly. Meadow dropseed.	Splitbeard. Broomsedge. Fringeleaf paspalum. Annual threeawn. Annual panicum. Annual lovegrass.
Legumes	Leadplant. Virginia tephrosia. Sessile tickclover. Slender lespedeza. Roundhead lespedeza. Trailing lespedeza. Catsclaw sensitivebrier.	Cream wild-indigo. Blue wild-indigo. Slimflower scurfpea.	Deervetch. Trailing wildbean.

SANDY SAVANNAH, SHALLOW SAVANNAH, AND SAVANNAH BREAKS RANGE SITES—Continued

Plants	Decreasers	Increasers	Invaders
Forbs	Blacksamson. Woodland sunflower. Stiff sunflower.	Ashy sunflower. Heath aster. White aster. Tall goldenrod. Dyersweed goldenrod.	Annual ragweed. Western ragweed. Bitter sneezeweed. Texas croton. Marestail. Black-eyed-susan.
Woody plants	Wild grape. Plume-tree. Poison-ivy. Flowering dogwood. Redbud. Red oak.	Buckbrush. Post oak. Blackjack oak. Hickory. Ash. American elm. Sumac. Greenbrier.	Persimmon. Hawthorn. Winged elm.

LOAMY BOTTOMLAND AND HEAVY BOTTOMLAND RANGE SITES

Plants	Decreasers	Increasers	Invaders
Grasses	Prairie cordgrass. Florida paspalum. River switchgrass. Virginia wildrye. Canada wildrye. Broadleaf uniola. Eastern gamagrass. Indiangrass. Big bluestem. Beaked panicum.	Sedge. Flat-sedge. Spikesedge. Bulrush. Nutrush. Longspike tridens. Buffalograss. Purpletop. Knotroot bristlegrass.	Windmillgrass. Annual brome. Three-awn. Broomsedge.
Legumes	Illinois bundleflower. Catsclaw sensitivebrier. Sessile tickclover. Roundhead lespedeza.	Cream wild-indigo. Indigobush.	Showy partridgepea. Deervetch.
Forbs	Wholeleaf rosinweed. Rough coneflower. Blacksamson.	Horsemint. Heath aster. Slim aster. Tall goldenrod. Dyersweed goldenrod. Hemp dogbane.	Seacoast sumweed. Giant ragweed. Tall ironweed. White snakeroot. Pennsylvania smartweed. Lanceleaf ragweed.
Woody plants	Passionvine. Poison-ivy. Wild grape.	Trumpetvine. Winged elm. Sumac. Buttonbush willow. Glove mallow. Bur oak. Pecan. Walnut.	Persimmon. Hawthorn. Post oak. Blackjack oak.

and to maintain fertility. High productivity can be maintained under good grazing management (fig. 17).

A range site is in *good* condition if 51 to 75 percent of the present vegetation is the same kind as that in the original stand. Sites in this class are generally satisfactory, though they produce less forage than those in excellent condition. The better perennial plants are dominant, but there are some less palatable plants. Erosion, if any, is slight.

A range is in *fair* condition if 26 to 50 percent of the present vegetation is the same kind as that in the original stand. The plant cover has decreased, and the soil may be subject to damage. The valuable forage plants have been considerably reduced in number, and in their place are less palatable or less productive plants. Also, the surface soil may be compacted and the penetration of water difficult.

A range site is in *poor* condition if less than 25 percent of the present vegetation is the same kind as that in the original stand. These sites have lost so much of the original stand that they produce only a small fraction of the amount of forage they are capable of producing. Few of the original kinds of plants remain. Most of the vegetation on these sites is low in palatability or productivity, or both. The soils are subject to deterioration and possibly to erosion.

Whether the range is improving or declining is not necessarily evident in the present range condition. Usually the trend of the range is determined before planning the changes in grazing use that are needed to maintain or improve the range. Some factors that indicate the trend of the range are discussed in the following paragraphs.

Plant vigor is reflected in the size of the plants in relation to their age and to the kind of site on which they grow. If the decreaser plants that have high grazing preference show an increased vigor, the range is improving.

The abundance of seedlings and young plants depends on reproduction by seed of the plants that are naturally dominant on the site. The presence of young seedlings, of plants of various ages, and of plants that spread by underground roots is evidence of effective reproduction of desirable grasses and of an improving range.

Changes in plant composition may result from a pronounced disturbance of the range, such as continued heavy grazing, prolonged drought, or repeated burning. An increase in plant species of low palatability generally indicates a trend toward lower range condition. If the

***Figure 17.*—Range in excellent condition on the Loamy Prairie range site. Soil is Okemah silty clay loam.**

disturbance causing the decline is corrected, however, the original plant community tends to become reestablished. Plants that have decreased in number because of the decline in range condition will increase if a source of seed or live roots is still present. Generally, the invasion of plants not native to the site indicates that the range is declining. Some invaders, however, particularly the annuals, may temporarily occupy the site in favorable years, even when the range is improving.

Plant residue accumulation depends on the total herbage production of the site; on the amount of herbage removed by grazing, haying, fire, wind, or water; and on the amounts decomposed in place. Progressive accumulation of plant residue indicates an improving range. High soil temperature and an increase in the rate of runoff and in soil loss result from an inadequate amount of plant residue. An increase in bare ground, in soil crusting, in compaction from trampling, and in erosion also indicate a declining range.

Descriptions of range sites

Soils that have a similar potential for producing vegetation are grouped into range sites. On the following pages the eleven sites in the county are described, and the soils on each site are listed. Also listed are the principal plants on each site and the plants that become abundant when the range is in poor condition (see also table 3 page 28). The inherent productive ability of different range sites depends on the combined effect of the soils and the climate. If the rancher knows the kind of range site, the kind of soils on the site, and the condition of the range, he can judge how well the range will produce forage and how it can be improved.

CLAYPAN PRAIRIE RANGE SITE

The soils of this site have a grayish-colored, loamy surface layer and a very compact clay subsoil. The very slowly permeable subsoil restricts penetration by water and roots. These soils usually are too wet in spring and too dry later in the year to produce as much forage as the best soils of the prairies. The soils are—

Parsons silt loam, 0 to 1 percent slopes.
Woodson and Summit soils, 0 to 1 percent slopes.

The plant community is dominantly switchgrass, indiangrass, big bluestem, little bluestem, and other tall grasses. Several different decreaser forbs and legumes are part of the climax composition. These, however, represent only a small percentage, by volume, as compared to grasses.

When the climax vegetation has had prolonged abuse, the plants that become abundant are broomsedge, meadow dropseed, tall dropseed, silver bluestem, perennial and annual three-awn, annual brome, ragweed, and goldenrod.

COAL STRIP MINES RANGE SITE

This range site is made up of a land type, Strip mines, which includes the areas that have been stripped for coal by heavy machinery. The dumps are made up of well-mixed shale, sandstone, and the original mantle of soil. The materials, in most places, have been left in parallel, rough, steep ridges.

The Coal Strip Mines range site produces a mixed vegetation similar to that of the adjacent prairie. Revegetation, however, is slow unless it is encouraged. Some landowners sow a mixture of native grass and sweetclover seed from an airplane during favorable seasons. Others have successfully sown biennial sweetclover after mining operations. Silver bluestem was the first perennial to become established in stands of sweetclover seeded on dumps. In time, big bluestem, switchgrass, and indiangrass became more adundant. With natural reseeding of grasses in sweetclover, and with proper management, mined areas have been restored to good cover of native grasses (fig. 18). Where heavy summer grazing and other poor management have been practiced, however, many mined areas have little or no grass cover.

LOAMY PRAIRIE RANGE SITE

This site consists of deep, loamy, well-drained, dark-colored or reddish soils. They are level to moderately sloping and occur in upland prairies. These soils have a good capacity for moisture storage and for root development. They produce more forage than any other soils in the uplands and make up the most extensive range site in the county (fig. 19). The soils are—

Bates-Collinsville complex.
Bates and Dennis soils, 3 to 5 percent slopes, eroded.
Breaks-Alluvial land complex (Breaks part).
Choteau silt loam, 1 to 3 percent slopes.
Claremore silt loam, 0 to 3 percent slopes.
Dennis-Bates complex, 2 to 5 percent slopes.
Dennis silt loam, 1 to 3 percent slopes.
Dennis silt loam, 3 to 5 percent slopes.
Eroded loamy land.
Newtonia silt loam, 0 to 1 percent slopes.
Newtonia silt loam, 1 to 3 percent slopes.
Okemah silty clay loam, 0 to 1 percent slopes.
Okemah silty clay loam, 1 to 3 percent slopes.
Okemah silty clay loam, 1 to 3 percent slopes, eroded.
Riverton loam, 1 to 3 percent slopes.
Riverton gravelly loam, 3 to 5 percent slopes.
Riverton gravelly loam, 3 to 5 percent slopes, eroded.
Summit silty clay loam, 1 to 3 percent slopes.
Summit silty clay loam, 3 to 5 percent slopes.
Summit silty clay loam, 1 to 5 percent slopes, eroded.
Taloka silt loam, 0 to 1 percent slopes.

The plants on this site are principally big bluestem, indiangrass, little bluestem, and switchgrass. There are several decreaser forbs and legumes, but they make up less than 10 percent of the total herbage produced.

After prolonged abuse of the range on the limestone soils of this site, the abundant plants are silver bluestem, meadow dropseed, tall dropseed, annual three-awn, late goldenrod, drummond aster, and annual broomweed. On overused sandstone soils the plants that increase are broomsedge, splitbeard bluestem, meadow dropseed, annual three-awn, perennial ragweed, ironweed, bitter sneezeweed, and annual ragweed.

SHALLOW CLAYPAN RANGE SITE

The one soil in this site, Dwight silt loam, 0 to 1 percent slopes, has a grayish-colored, loamy surface layer about 6 inches thick that is abruptly underlain by a dense, compact clay subsoil. The very slowly permeable subsoil restricts moisture penetration and root growth. Because of the shallow surface layer and the dense claypan subsoil, this soil is extremely wet in wet years and excessively dry in the dry years, and the quantity and quality of forage are therefore limited. This range site has the lowest production in the county.

Mixed mid and tall grasses are common in this site. In favorable years switchgrass, rushes, sedges, and similar

Figure 18.—**Coal Strip Mines range site producing good-quality herbage. Big bluestem and switchgrass have reseeded naturally in area that was originally seeded to sweetclover.**

plants adapted to wet areas are abundant. When rainfall is below normal, dropseed, along with perennial three-awn, becomes more abundant. After prolonged overuse of this site, perennial and annual three-awn dominate.

SHALLOW PRAIRIE RANGE SITE

Collinsville stony loam is the only soil in this range site. It developed in most places from sandstone and shale. It is shallow. Its capacity for moisture storage is fair. Plant roots penetrate this soil readily, despite the stones in the profile.

The decreaser plants abundant on the site when it is in excellent condition are big bluestem, little bluestem, indiangrass, switchgrass, Virginia tephrosia, catsclaw sensitivebrier, and perennial sunflower.

When the site is in poor condition, it has a brushy cover of persimmon, hawthorn, coralberry, sumac, and blackberry briers and patches of broomsedge, ragweed, and three-awn.

Brush control is often necessary to speed recovery of the native grasses on this site. Applying chemicals, mowing with a brush mower, and controlled grazing are the most commonly used practices.

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VERY SHALLOW RANGE SITE

Sogn soils, an undifferentiated group, is the only mapping unit in this site. They are very shallow soils that have a dark-colored, loamy or clayey surface layer over limestone bedrock. Some areas are very stony. The surface soil is underlain by solid, horizontal limestone, which limits moisture storage and root growth (fig. 20).

The deeper soils on this site support big bluestem, little bluestem, indiangrass, and switchgrass. Under good management, the more shallow soils support sideoats grama, gayfeather, and willowleaf sunflower.

Plants abundant when this site is in poor condition are common broomweed, annual ragweed, silver bluestem, pricklypear, and buffalograss. Scattered motts of persimmon and individual hawthorn plants are also common. The brush can be controlled by spraying with chemicals and by use of proper grazing practices.

SANDY SAVANNAH RANGE SITE

This site consists of deep, loamy, brown soils that are gently sloping to moderately sloping and are well drained. They are forested soils in the uplands. The soils have a

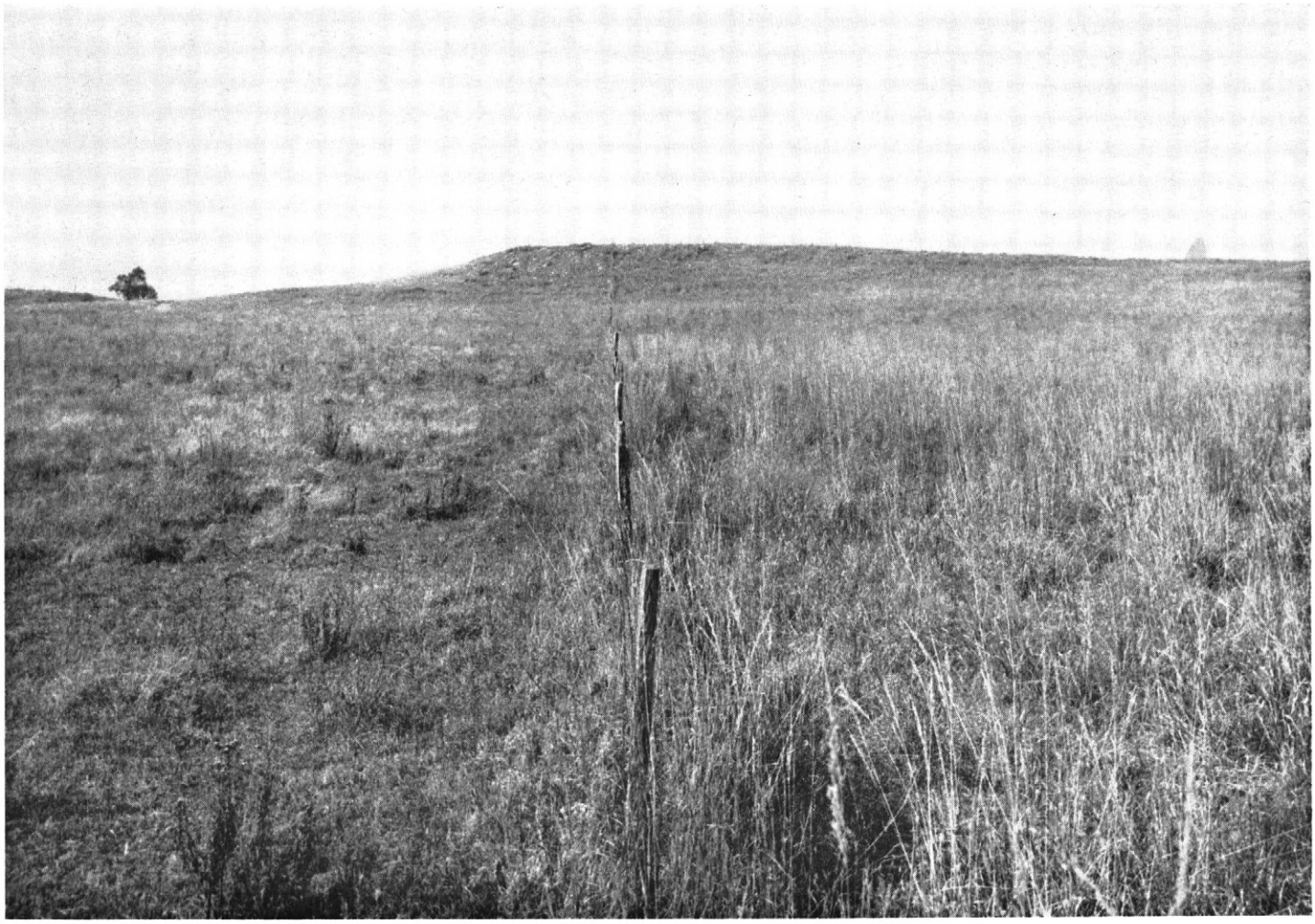

Figure 19.—Loamy Prairie range site in foreground and Shallow Prairie range site in background. On right, properly used range in excellent condition; on left, overused range in poor condition.

Figure 20.—Very Shallow range site in excellent condition.

good capacity for moisture storage and for root development. The soils are—

Linker fine sandy loam, 1 to 3 percent slopes.
Linker fine sandy loam, 3 to 5 percent slopes.
Linker part of the Hector-Linker fine sandy loams, 1 to 5 percent slopes.

Under optimum conditions, big bluestem, little bluestem, indiangrass, and switchgrass are the dominant grasses in a scattered, open stand of post oak, blackjack oak, and hickory. The tree canopy does not exceed 10 percent. Production of herbage is good. Figure 21 shows a typical view of the Sandy Savannah range site.

When range condition has declined, post oak, blackjack oak, hickory, persimmon, American elm, and winged elm become abundant on this site. In poor condition the site is covered with brush and scrub hardwood; very little grass (panicum) grows under the dense canopy.

Brush control is needed to renew the grass on this site. Common practices to control brush are the use of chemicals, clearing with bulldozers, and mowing; grazing control is also commonly used.

SAVANNAH BREAKS RANGE SITE

Rough stony land makes up this range site. This land type consists of shallow, stony, loamy areas. These areas are forested and occur in the uplands. Large rock out-

Figure 21.—Sandy **Savannah range site that has an open stand of oak trees and an ample stand of mixed tall grasses.**

crops limit production on this site. Because of the steep slope, runoff is excessive.

This site under top range condition supports an open stand of red oak, post oak, blackjack oak, and hickory trees; little bluestem, big bluestem, and indiangrass are in the open areas. In most places little bluestem is the dominant grass. When this site is in excellent condition, the tree canopy does not exceed 20 percent.

Under deteriorated condition this site has the appearance of a closed savannah. The post oak, blackjack oak, hickory, ash, elm, persimmon, and hawthorn form a dense, solid canopy, and grass is restricted to panicum and other annuals.

Brush control is necessary if this site is to be restored to good or excellent condition in a reasonable length of time. The cost, however, makes restoration doubtful.

SHALLOW SAVANNAH RANGE SITE

This site consists of very shallow, brown, loamy soils that are stony, gently sloping to steep, and somewhat excessively drained. They are forested soils in the uplands. In some areas as much as 12 percent of the acreage consists of deep soils. The capacity of the soils in this site for water storage and root development is fair. The vegetation is similar to that on Savannah Breaks range site but is more abundant. The soils are—

Hector stony sandy loam.
Hector part of Hector-Linker fine sandy loams, 1 to 5 percent slopes.

This site in excellent condition has an open stand of post oak, hickory, and blackjack oak trees and big bluestem, little bluestem, indiangrass, and switchgrass in the open areas. Legumes and forbs are numerous, but they produce only a small part of the herbage, as compared with the grasses. A 15 percent canopy is normal when this site is in excellent condition.

A brushy, low-producing range covered with a dense stand of post oak, blackjack oak, hickory, and ash is typical when this site is in poor condition. Annual panicum, brome, and lovegrass are common under the tree canopy.

Brush control is profitable if there are enough seed-producing plants under the brush (fig. 22).

HEAVY BOTTOMLAND RANGE SITE

Osage clay is the only soil on this range site. It is a level, poorly drained, very slowly permeable soil on bottom lands. Flooding occurs frequently in wet years.

Figure 22.—**Shallow Savannah range site. After scrub oak trees were killed by aerial spray, tall native grasses are making a good recovery.**

Herbage production on this site is high when there is enough rainfall and when flooding is not excessive. The site supports tall grasses. The quality of the forage is lower, however, than that of the prairie forage. Prairie cordgrass is the dominant plant on this site. Where surface drainage is fairly good, eastern gamagrass, broadleaf uniola, river switchgrass, Florida paspalum, indiangrass, wildrye, and big bluestem are common, along with numerous sedges and rushes.

After prolonged abuse, the site is dominated by elm, oak, hawthorn, and trumpetvine. Greenbrier, lanceleaf ragweed, seacoast sumpweed, goldenrod, and aster grow under the brushy canopy. Practices commonly used to control brush are spraying with chemicals, clearing with bulldozers, and regulating grazing.

LOAMY BOTTOMLAND RANGE SITE

On this site are deep, dark-colored, level soils that are permeable or moderately permeable and are subject to occasional flooding. Fertility is high. Because they are deep, these soils have a good capacity for moisture storage and for root development. The soils are—

Breaks-Alluvial land complex (Alluvial land part).
Verdigris soils, frequently flooded.
Verdigris clay loam.
Verdigris silt loam.

The yield of herbage is high if the site is not excessively flooded. Tall grasses common in prairies grow on the higher parts of the site. Prairie cordgrass, sedges, and rushes are common in the lower, wet areas. Prairie cordgrass increases in wet years and decreases in dry years. Big bluestem, however, reacts in the opposite way.

After prolonged abuse of the site, the principal plants are goldenrod, aster, giant ragweed, persimmon, post oak, blackjack oak, pecan, and elm. Brush control is needed to hasten the recovery of overused range.

Range site productivity

Estimates in table 4 show the relative productivity of the range sites by range condition class. The estimates are based on limited studies of clippings made during years of average or heavy rainfall. In dry years herbage production is substantially lower, often by as much as 50 percent or more.

The quality, and generally the quantity, of usable forage is much higher when the site is in good or excellent condition than when it is in fair or poor condition. The herbage from old fields and from sites in fair or poor condition is made up primarily of weeds and low-quality grasses. Savannah sites formerly cultivated that are returning to native grasses usually yield more total herbage than the Savannah sites in poor condition and under a dense cover of brush.

The estimates in table 4 are for total herbage, clipped at ground level and air dried. Normally, the amount of usable forage for grazing or for hay will be considerably less than that shown. If the site is managed so that half of the year's growth is left, the animals may actually consume only about 25 to 35 percent. Natural losses to rodents, to insects, by weathering, and from other causes account for the rest.

TABLE 4.—*Estimated average acre yields of air-dry herbage*

Range site	Condition class				
	Excellent	Good	Fair	Poor	Old fields
Claypan Prairie	5, 000	4, 000	3, 500	3, 000	2, 500
Coal Strip Mines	(1)	(1)	2, 000	1, 000	(2)
Loamy Prairie	6, 500	6, 000	3, 500	3, 400	3, 400
Shallow Claypan	2, 000	1, 000	500	250	250
Shallow Prairie	5, 000	4, 500	3, 500	3, 000	2, 500
Very Shallow	3, 000	2, 750	2, 500	2, 000	(2)
Sandy Savannah	5, 000	4, 500	1, 500	750	3, 000
Savannah Breaks	3, 000	2, 000	1, 000	500	(2)
Shallow Savannah	4, 750	1, 250	1, 250	500	2, 500
Heavy Bottomland	7, 000	5, 000	3, 500	3, 000	3, 000
Loamy Bottomland	11, 500	9, 000	8, 500	5, 500	5, 500

[1] Data not available.
[2] No old fields on the site.

Principles of range management

Proper grazing practices are the most important part of range management. Grazing should be regulated so that enough cover is left to protect the soil and maintain the quantity and quality of desirable plants. Enough forage should remain unused at the end of the growing season to maintain a healthy stand of the best grasses. According to experienced ranchers, about half of the annual plant production, by weight, can be grazed off without lowering the yield or reducing the stand. Repeated or prolonged overuse of a range reduces the ability of the plants to produce the deep roots, seeds, and new shoots necessary for reproduction and maintenance of the stand.

Operators who are familiar with their sites and the main grasses generally understand signs of improvement or decline in range condition and adjust management to fit the condition.

Specific information about the stocking of rangeland is not included in this report. Technical personnel of the local agricultural agencies help ranchers to classify range sites and to estimate the condition of the range and the number of animals to stock. In the following paragraphs, some important practices of range management in Rogers County are discussed.

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Uniform grazing.—Practices that promote uniform grazing are beneficial to the range. Changing the locations of salt can help to obtain uniform grazing. Grazing near the salting or watering places can be destructive, even though grazing is light in distant parts of the same site. Building another pond or developing another watering place can help to distribute grazing. Fencing is costly, but it can be used if other practices are not successful.

Deferred grazing.—This practice excludes all livestock from a pasture or range for a specified time during any growing season. It is used to hasten the recovery of an overgrazed range that still has enough decreaser plants. If there are not enough decreaser plants, this practice should be accompanied by range seeding. Deferred grazing should be started at the beginning of the growing season for native grasses, usually about the first of April, and be continued through to the middle of October. This period gives the decreasers, which include big bluestem, little bluestem, switchgrass, indiangrass, good legumes, and forbs, a chance to increase in number and vigor and crowd out less desirable plants. Three months deferred grazing, beginning in mid-July, allows plants to produce seed for harvest if the weather is favorable.

Development of watering places.—The locations of watering places should be planned to provide the best possible distribution of grazing within a large site. Any barriers to the movement of livestock, however, should be considered. Water should be provided in small pastures for the grazing season. The cost per acre of providing water can be reduced by arranging fences or locating the watering places so that they provide water for two or more pastures.

Range seeding.—Reseeding of native grass is needed on idle cropland that is being returned to pasture. Seeding is also needed on overgrazed range in poor condition that is not expected to return to a good stand of bluestem grasses after a reasonable period of deferred grazing. A mixture of big bluestem, little bluestem, switchgrass, and indiangrass should be seeded (fig. 23). A clean seedbed is used, though good results can be obtained by drilling the seed in sorghum stubble or by overseeding on rangeland in poor condition. A high-yielding range of native grasses can be established by (1) preparing a good seedbed, (2) using good quality seed, (3) controlling weeds and brush, and (4) deferring grazing for two growing seasons.

Brush control.—If rangeland is overused on some sites, a thick stand of brush invades the weak, depleted stand of native grasses. Brush that is crowding out or suppressing the native plants as a result of overgrazing can be controlled by foliage spraying and deferred grazing for two seasons. Returns from moderate grazing during the dormant, or winter, season help defray the cost of spraying, and such grazing does little damage to the grass.

Range meadow.—In Rogers County it is estimated that a total of 21,000 acres of native bluestem is cut annually for hay. Most meadows are on gently sloping soils that have no stones to hinder mowing and raking. Generally, the meadows are better managed than the native grass pastures.

As a general rule, on the uplands, one cutting late in June or early in July allows time for regrowth before frost. This regrowth helps to maintain a good, vigorous

Figure 23.—**A seeding of big bluestem, little bluestem, switchgrass, and indiangrass on the Loamy Prairie range site. The seeding is two years old and in excellent condition.**

stand of the best kind of grasses. By contrast, a single cutting in August or September results in stemmy hay of low nutritive value, and repeated late annual mowing or double mowings reduce the vigor of the grass, as well as lower the quality of hay.

Meadows that are mowed early in summer often produce forage that may be grazed in winter without damaging the stand. Light grazing can be done during the winter if the soil is firm.

The cutter bar of the mower should be adjusted to cut above the first joint of the grass—about 3 or 4 inches above the soils. Cutting at this height encourages moderate regrowth and hastens the recovery of the grasses. Almost all plant food is manufactured in the green leaves.

Range site and range condition class are determined for range meadows by the same method as for native pastures.

Fireguards.—Burning over the range reduces plant cover, exposes young grass shoots to heavy grazing, encourages water erosion, kills beneficial insects, increases loss of water, and destroys food and cover for wildlife. In addition, the fire often gets beyond control and may destroy buildings, fences, livestock, and other kinds of property. Fireguards are needed to prevent or reduce these and other losses. They should be at least 8 feet wide (fig. 24). All flammable material should be removed from the fireguard with a plow, bulldozer, or grader late in summer or early in fall.

Mowing a strip of tall grasses and raking it clean help to control erosion on steep slopes. When weather conditions are favorable, the grass between the cleaned strip and the road can be burned to give added protection. Fire fighting equipment, however, should be kept near the area until all fire is out. Also, fenceposts in the area that is burned need protection.

Ranchers and farmers generally consider burning a poor practice. Ranchers depend on the dry, standing, native grasses for winter grazing. If protein supplement is fed, the dry grass will carry livestock through the winter. If the dry, native grasses are destroyed, then baled hay must be purchased and fed to livestock in winter. Most ranchers have spray tanks or other fire-fighting equipment for use when fire breaks out within the ranch or when high winds cause a fire to jump across the fire-

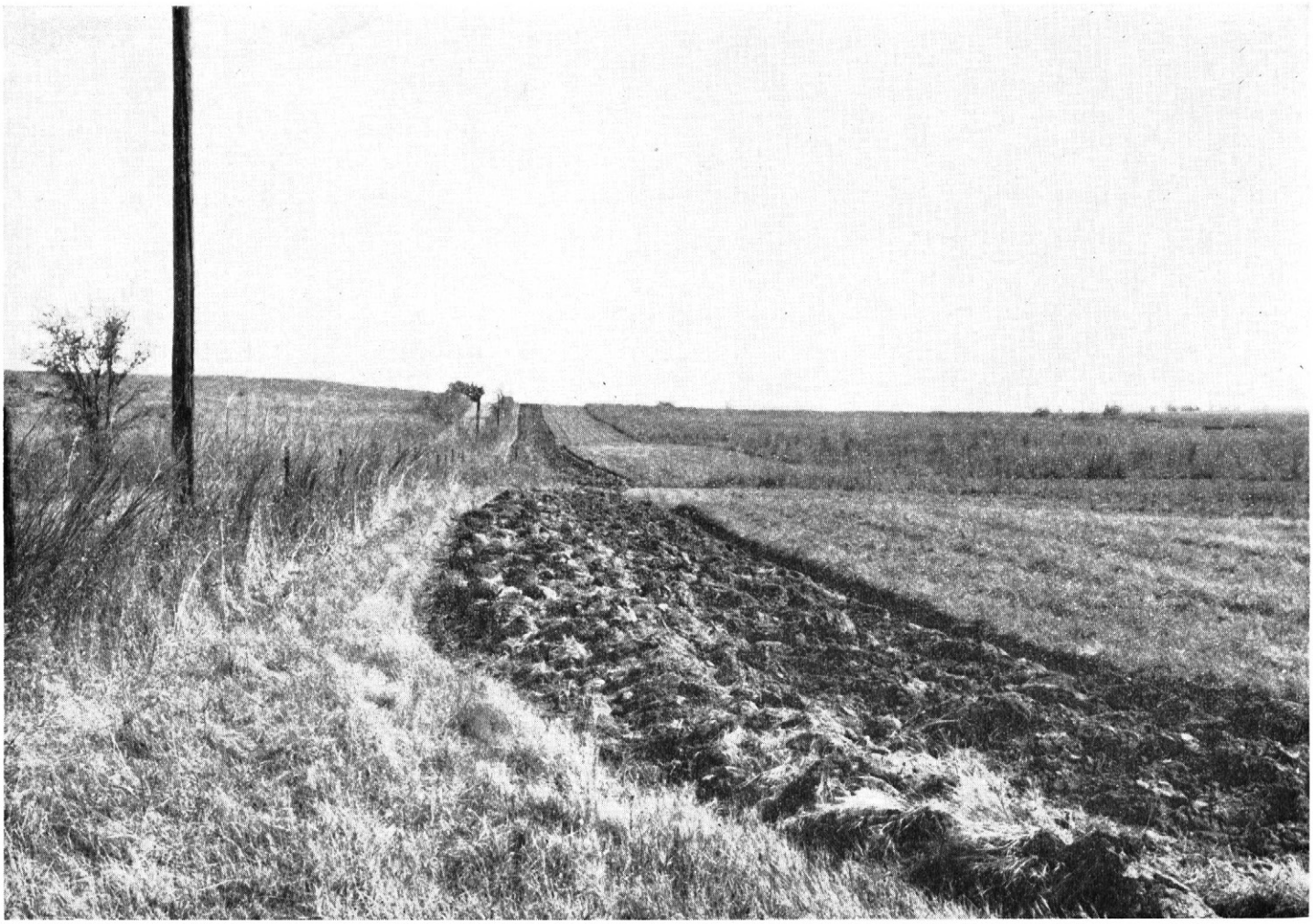

Figure 24.—**A good fireguard. It consists of a plowed strip and a strip mowed and raked around the outside of the field.**

guard. Building fireguards, use of equipment for fighting fires, and a better understanding of the effects of burning have greatly reduced the loss from fire in the county in recent years.

Cattle walkways.—On the Coal Strip Mines range site, cattle walkways help to distribute grazing. In most places, cattle have to enter the stripped area at the end of the mine dumps, if walkways are not available. Also, in most places the dumps are inaccessible from one side because of a vertical bank left when mining is finished. The parallel ridges of the dumps are usually overgrazed near the ends and are seldom grazed near the middle, unless walkways are built. Four walkways per mile, built perpendicular to, or across, the ridges, help to distribute grazing and to assist the ranchers in managing the herd.

Wildlife [4]

The dominant wildlife habitats in Rogers County are the upland prairies, forested uplands, and forested bottom lands. The distribution and extent of these areas are shown on the general soil map at the back of this report.

[4] By JEROME F. SYKORA, biologist, Soil Conservation Service.

The upland prairies are distributed throughout the county and make up about 75 percent of its total area. They are in associations 1, 2, and 3 and include the Dennis, Bates, Choteau, Collinsville, Newtonia, Summit, and Sogn soils.

The forested uplands are largely in the east-central and northeastern parts of the county in soil association 5. They include the Hector and Linker soils.

The forested bottom lands are in narrow strips along the Caney and Verdigris Rivers and their tributaries in soil association 4. They include the Osage and Verdigris soils.

Kinds of wildlife.—The most important kinds of wildlife in this county are bobwhite, or quail, mourning doves, fox and gray squirrels, and cottontail and swamp rabbits. There are a few deer along the breaks and in wooded areas. Among the furbearers are mink, muskrats, opossums, skunks, and raccoons. Opossums are most numerous and are most widely distributed. There are still some small flocks of prairie chickens in some of the well-managed prairies. Some migratory waterfowl stop over during the spring and fall migrations. The principal predatory animals are coyotes, red and gray foxes, and a few

bobcats; predatory birds are hawks and owls. Many beneficial songbirds that eat insects and seeds nest throughout the county.

Kind of wildlife habitat.—Most species of wildlife use for habitats the areas, called edges, created by a change in the pattern of vegetation. The bobwhite and cottontail rabbits are especially attracted to low, brushy cover in wooded ravines; berry patches in rangeland; vegetation along road sides; brushy fence rows; weed patches; and waste grain along the edge of cropland. Small fields and light grazing create favorable conditions for these species.

A good habitat for mourning doves occurs throughout the county. Doves fly a considerable distance in search of food, which consists of weed seeds and waste grain.

The more heavily wooded bottom lands along the larger streams are good habitats for mink, squirrels, swamp rabbits, and raccoons. These areas provide small animals and birds for mink, nut and fruitbearing trees for squirrels, and choice wetland food plants for swamp rabbits. The raccoons and the gray and fox squirrels use den trees to escape from enemies and to rear their young.

The forested areas and wooded ravines in the prairies, where numerous kinds of shrubs are available for browse, provide moderate to good habitats for deer.

Only the large areas of native grasses that are in good condition and are lightly to moderately grazed are suitable for prairie chickens. These birds are attracted to fields that provide grain or green vegetation and to clumps of trees producing acorns. The less turbid ponds that produce an abundance of aquatic weeds provide fair conditions for waterfowl and muskrats. The mallard and pintail ducks make use of waste grain in large fields. Geese are attracted to fields of winter-growing small grain for food and to the large flood control reservoir for a resting area.

Wildlife habitat improvement.—Most game animals are probably limited most severely by lack of food and a protective cover during the winter. It is necessary to keep a good cover for quail and, in some places, to plant additional cover. Protected natural cover along field borders and fence rows provides travel lanes and food. Excellent runways that furnish some food can be established by seeding sericea lespedeza and grasses in strips (fig. 25) along the edge of fields and woodlands. Pastures, forested ravines, odd areas, fields in fallow, and field edges that are fertilized and overseeded with Korean lespedeza provide excellent food for quail.

Habitats for squirrels can be improved by protecting den trees and by increasing the number of trees producing nuts and fruits. Almost all wildlife will benefit if burning and overgrazing are eliminated.

Habitats for ducks can be improved by providing devices to control the water level of farm ponds and lakes so that shorelines can be planted to food plants in summer and can be flooded during the migration period. Most ducks benefit from pond management that provides an abundance of aquatic plants.

It is usually not feasible to manage areas of less than 6,000 acres for deer and wild turkeys. Generally, the management of large areas requires the cooperation of a group of landowners. Complete protection from year-round hunting, deer-running dogs, and severe overgrazing must be provided before these species can be successfully re-established. Deer and wild turkeys benefit from properly fertilized plantings of small grain and legumes. Their food supply can also be improved by clearing heavily forested areas to permit the growth of shrubs and desirable seed-producing plants. If the habitat is suitable but foundation stock is lacking, deer and turkeys are sometimes available through the State wildlife agency.

Figure 25.—Sericea lespedeza and grasses along the border of field provide wildlife food and cover.

Fish.—The larger streams and lakes of the county produce channel and flathead catfish, bullhead, buffalofish, carp, crappie, bass, and sunfish. The many farm ponds and coal strip mine pits produce largemouth bass, bluegill, and channel catfish under proper management. Farm ponds used for fish production should be at least one-half an acre in size. The drainage area should be well protected by vegetation and a diversion ditch provided to prevent excessive flow of water through the pond. The shorelines should slope steeply to a depth of at least 2 feet. The pond should be deep enough to maintain the fish during dry periods.

Good pond management includes: (1) provision of clear, unpolluted water; (2) proper stocking; (3) fertilizing to control underwater weeds and to provide more food for fish; and (4) adequate removal of all species as they become usable. If the ratio of species becomes unbalanced, all fish should be eliminated and the pond restocked.

Ponds built in Taloka, Choteau, Parsons, and Okemah soils have a tendency to be turbid. They can be improved by planting eroded areas, diverting turbid water, eliminating livestock trampling, and adding gypsum. They can also be improved by providing organic matter in the form of green plants, hay, or manure. Turbid ponds that cannot be kept clear should be stocked only with channel catfish.

Additional aid.—Aid in the management of fish ponds and farm game may be obtained through the Oklahoma Department of Wildlife Conservation, the U.S. Fish and Wildlife Service, the State University Extension Service, and the local offices of the Soil Conservation Service and the county agricultural agent.

Woodland Management [5]

Originally, Rogers County was mainly a vast prairie. Climax prairie grasses dominated in most areas. A mixed oak-hickory forest and tall prairie grasses occupied some sandstone ridges (soil association 5). There were a few areas of cedars on the breaks of the limestone bluffs. Pecan, walnut, elm, maple, hackberry, oak, ash, sycamore, willow, and other adapted species invaded the river and creek bottoms, and usually were in groves (soil association 4).

According to a report by early settlers, both before and after the Civil War, few trees were large enough to provide logs for cabins or lumber for houses. Houses were built of lumber hauled from Grand River or Spavinaw Hills, which were 30 to 60 miles to the east. It is estimated that open stands of timber occupied approximately 60,000 acres from 30 to 60 years ago. These stands were on Hector stony sandy loam, Linker fine sandy loam, Verdigris clay loam, Verdigris silt loam, and Osage clay.

Today, woodland makes up approximately 10 percent of the land area, or an estimated 40,000 acres. Most of this woodland is used for grazing. There has been little interest in managing native woodlands for timber production. Most of the cutting has been done by private owners for fuel or fenceposts; occasionally trees were cut for lumber. A few operators of small sawmills cut the better trees. As there has been little or no market for native lumber, methods of marketing have been varied and piecemeal. Landowners usually have received little income from timber sold either to log buyers or to sawmill operators.

Practically all of the timber in the county is on privately owned land; there is little, if any, virgin timber. The principal species cut for lumber or logs are black walnut, white oak, red oak, burr oak, pin oak, post oak, sycamore, pecan, and hackberry. The less important species cut are red elm, white elm, black cherry, hickory, ash, and black oak.

In addition to the harvest of nuts from pecan and walnut trees, the present use of woodlands is for wildlife food and cover, recreation, scenery, and, in a few instances, for fuel, fenceposts, and lumber. Black walnut logs are in demand.

The first wire fences constructed before Oklahoma became a State were nailed to oak fenceposts. The posts cost from 2 to 5 cents each and were cut and split out of native white, red, or post oak trees. These posts lasted from 2 to 15 years, depending on the kind of tree and number of years of seasoning. The trees were not managed for post production. After the local supply of timber suitable for posts was depleted, posts were hauled from the forested hills east of the county. Since manufactured metal posts and creosoted pine posts are available, almost no local farmers now cut their own posts.

Several soils are well adapted to the production of posts if the proper species are planted and managed. The species best adapted to the soils of Rogers County are black locust, catalpa, and bois d'arc. If they are planted 6 feet apart in rows that are also 6 feet apart, these species will produce approximately 1,200 posts per acre in 7 to 15 years. If trees are cut when dormant to maintain vigor of the roots, and the sprouts are properly pruned and managed, posts can be produced every 4 to 7 years.

Bois d'arc and black locust posts last from 20 to 60 years in this climate, and catalpa a few years less.

The best soils for post-lot planting are Bates loam, Choteau silt loam, Dennis silt loam, Newtonia silt loam, Okemah silty clay loam, Riverton gravelly loam, Hector-Linker fine sandy loams, Summit silty clay loam, Taloka silt loam, Verdigris silt loam, Osage clay, and Strip mines.

[5] By MYRON A. HURD, work unit conservationist, Soil Conservation Service.

Engineering Uses of the Soils [6]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. The properties most important to the engineer are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and pH. The depth to water table and to bedrock and the topography also are important.

The information in this report can be used to:

1. Make soil and land use studies that will aid in selecting and developing sites for industrial, business, residential, and recreational uses.
2. Make preliminary estimates of the engineering properties of soils that will help in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will help in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other material for use in construction.
5. Correlate performance of engineering structures with soil mapping units, and thus develop information for planning that will be useful in designing and maintaining the structures.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs for making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

The engineering interpretations reported here can be useful for many purposes. It should be emphasized, however, that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depth of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used by the soil scientist may not be familiar to the engineer, and some terms may have a

[6] Prepared by FREDERICK E. KEETER, engineer, Soil Conservation Service.

special meaning in soil science. Several of these terms are defined in the Glossary at the back of the report.

Engineering properties, interpretations, and soil test data

To be able to make the best use of the soil maps and the soil survey report, the engineer should know the properties of the soil materials and the condition of the soil in place. The three tables—5, 6, and 7—in this subsection contain a summary of soil properties significant to engineering and some engineering interpretations.

In table 5 the soils of the county are listed and briefly described, and estimates of their physical and chemical properties that affect engineering works are given. The estimated properties are based on a typical profile of each soil. Where test data are available, the data shown are for the modal, or typical, profiles. Where tests were not performed, the estimates shown are based on test data obtained from similar soils in this county or other counties nearby and by past experiences in engineering construction. The soil profile is divided into layers significant to engineering uses, and the thickness and depth of each layer are given. A more complete description of soil profiles is given in the section "Formation, Classification, and Morphology of Soils."

In table 5 soil texture is described according to the classification used by the U.S. Department of Agriculture,[7] the system used by the American Association of State Highway Officials (AASHO),[8] and the Unified system developed by the Corps of Engineers, U.S. Army.[9]

In the system used by the U.S. Department of Agriculture, the texture of the soil horizon (layer) depends

[7] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY MANUAL. Agr. Handb. No. 18, 503 pp., illus. 1951

[8] AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 pts., illus, Washington, D.C. 1961.

[9] U.S. ARMY, CORPS OF ENGINEERS. THE UNITED SOIL CLASSIFICATION SYSTEM. Tech. Memo. 3-357, v. 1, illus. 1953.

TABLE 5.—*Brief description of soils of Rogers County*

[Dashed lines indicate properties

Map symbol	Soil	Description of soil and site	Depth from surface	Classification
				USDA texture
			Inches	
Bc	Bates-Collinsville complex.	Bates soils: Well-drained soils in the uplands; sandstone at a depth of 2 to 4 feet; medium internal drainage. Collinsville soils: For description and estimated properties, see Collinsville stony loam.	0–10 10–16 16–36	Loam Heavy loam Light clay loam
BdC2	Bates and Dennis soils, 3 to 5 percent slopes, eroded.	Bates soils: For description and estimated properties, see Bates-Collinsville complex. Dennis soils: For description and estimated properties, see Dennis silt loam, 1 to 3 percent slopes.		
Bp	Borrow pits.	A land type consisting of areas from which soil material has been removed; little depth to sandstone or shale; properties highly variable.	----	----
Br	Breaks-Alluvial land complex.	A land type consisting of breaks along prairie drainageways; deep and shallow, irregularly sloping soils; sandstone or shale at a depth of 1 to 5 feet; lateral internal seepage; properties highly variable.	----	----
ChB	Choteau silt loam, 1 to 3 percent slopes.	Well-drained soil from old alluvium in the uplands; slow internal drainage; seasonally high water table at 16 to 26 inches; sandstone or shale at a depth of 5 to 10 feet.	0–26 26–60+	Silt loam Clay loam
CmB	Claremore silt loam, 0 to 3 percent slopes.	Well-drained soil in the uplands; limestone at a depth of 1 to 2 feet; medium internal drainage.	0–10 10–22	Silt loam Silty clay loam
Co	Collinsville stony loam.	Excessively drained, stony soil in upland prairies; sandstone or sandy shale at a depth of 6 to 12 inches; lateral internal seepage.	0–5 5–10	Stony loam Silt
DbC	Dennis-Bates complex, 2 to 5 percent slopes.	Dennis soils: Well-drained soils in the uplands; internal drainage slow; seasonally high water table at a depth of 14 to 18 inches; shale or sandstone at 3 to 5 feet. Bates soils: For description and estimated properties, see Bates-Collinsville complex.	0–14 14–34 34–50	Silt loam Clay loam Clay loam

on the proportional amount of the different sized mineral particles. The soil materials are classified as cobblestones, gravel, sand, silt, and clay. Rarely does a soil consist of only one particle size, but a particle size may dominate so that a soil exhibits the characteristics of material composed of only that particle size. For example, a soil consisting of 40 percent clay is called *clay*. Characteristically, it feels slick, sticky, and plastic when wet.

Texture of a soil is closely associated with its workability, fertility, permeability, erodibility, and other important characteristics. Representative textural groups from finest to coarsest are (1) fine-textured soils (clay, silty clay, and sandy clay); (2) medium-textured soils (loam and silt loam); and (3) coarse-textured soils (loamy sand, sand, and coarse sand).

The AASHO classification system is used to classify soils according to their engineering properties, as determined by their performance in highways. In this system soils are placed in seven principal groups, designated as A–1 through A–7. The groups range from A–1, consisting of gravelly materials of high bearing capacity to A–7, consisting of clayey materials that have low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. The range for the group index number is from 0 for the best material to 20 for the poorest.

In the Unified classification system, the soils are identified on the basis of their texture and plasticity and on their performance as material for engineering construction. The soil materials are identified as coarse grained, which are gravels (G) and sands (S); fine grained, which are silts (M) and clays (C); and highly organic soils (O). In this system clean sands are identified by symbols SW and SP; sands with fines of silt and clay are identified by the symbols SM and SC; silts and clays that have a low liquid limit are identified by the symbols ML and CL; and silts and clays that have a high liquid limit are identified by the symbols MH and CH.

and their estimated physical and chemical properties

were not determined]

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic soil group
Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per inch of soil	*pH value*		
ML	A–4	90–100	90–100	70–80	Moderate	0.14	5.6	Low	B.
ML, CL	A–4	90–100	85–95	70–80	Moderately slow	.17	5.2	Low	
ML, CL	A–4	90–100	85–95	70–80	Moderately slow	.17	5.0	Moderate	
ML, CL	A–4	100	100	75–90	Moderate	.14	5.3	Low to moderate	C.
CL	A–6	100	100	70–95	Slow	.17	5.5	Moderate	
ML, CL	A–4	100	100	85–95	Moderate	.14	6.0	Low to moderate	B.
CL, ML	A–6, A–7	100	100	85–95	Moderate	.17	6.0	Moderate	
ML, CL	A–4	75–85	70–80	50–70	Moderate	.12	6.0	Low	C.
ML	A–5	70–85	65–75	55–65	Moderately slow	.12	6.0	Low	
ML, CL	A–4	100	100	75–90	Moderate	.14	6.0	Low to moderate	C.
CL	A–6	100	100	75–95	Moderately slow	.17	5.3	Moderate	
CL	A–6	100	100	75–95	Moderately slow	.17	5.3	Moderate	

TABLE 5.—*Brief description of soils of Rogers County and*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification
				USDA texture
			Inches	
DnB	Dennis silt loam, 1 to 3 percent slopes.	Well-drained soils in the uplands; internal drainage slow; seasonally high water table at a depth of 14 to 18 inches; shale or sandstone at 3 to 5 feet.	0–14	Silt loam
DnC	Dennis silt loam, 3 to 5 percent slopes.		14–34	Clay loam
			34–50	Clay loam
DwA	Dwight silt loam, 0 to 1 percent slopes.	Poorly drained soil in the uplands; very slow internal drainage; seasonally high water table at a depth less than 4 inches.	0–6	Silt loam
			6–30+	Clay
Er	Eroded loamy land.	Well-drained land type in the uplands; sandstone or shale at a depth of 2 to 4 feet; medium internal drainage; lateral internal seepage.	0–6	Loam
			6–14	Light clay loam
			14–24	Weathered shales
Gp	Gravel pits.	A land type consisting of areas from which gravel has been excavated; little depth to sandstone or shale; properties highly variable.		
Hc	Hector stony sandy loam.	Excessively drained, stony, forested soil in the uplands; sandstone at a depth of 5 to 14 inches; lateral internal drainage.	0–12	Fine sandy loam
			12+	Weathered sandstone.
HlC	Hector-Linker fine sandy loams, 1 to 5 percent slopes.	Hector soils: For description and estimated properties, see Hector stony sandy loam. Linker soils: For description and estimated properties, see Linker fine sandy loam, 1 to 3 percent slopes.		
LkB	Linker fine sandy loam, 1 to 3 percent slopes.	Well-drained forested soils in the uplands; sandstone at a depth of 2 to 6 feet; medium internal drainage; seasonally high water table at a depth less than 2 feet.	0–16	Fine sandy loam
LkC	Linker fine sandy loam, 3 to 5 percent slopes.		16–28	Sandy clay loam
			28–40	Sandy clay loam
NaA	Newtonia silt loam, 0 to 1 percent slopes.	Well-drained soils in the uplands; limestone or shale at a depth of 2 to 6 feet; medium internal drainage.	0–14	Silt loam
NaB	Newtonia silt loam, 1 to 3 percent slopes.		14–38	Silty clay loam
OkA	Okemah silty clay loam, 0 to 1 percent slopes.	Well-drained soils in the uplands; slow internal drainage; seasonally high water table at a depth of 12 to 16 inches; sandstone or shale at a depth of 3 to 7 feet.	0–18	Silty clay loam
			18–35	Clay
OkB	Okemah silty clay loam, 1 to 3 percent slopes.		35–60+	Clay
OkB2	Okemah silty clay loam, 1 to 3 percent slopes, eroded.			
Os	Osage clay.	Poorly drained, heavy soil on bottom lands; very slow internal drainage; subject to occasional flooding.	0–34+	Clay
PaA	Parsons silt loam, 0 to 1 percent slopes.	Somewhat poorly drained soil in the uplands; very slow internal drainage; seasonally high water table at a depth of 6 to 12 inches; sandstone or shale at a depth of 3 to 8 feet.	0–11	Silty loam
			11–52+	Clay
RmB	Riverton loam, 1 to 3 percent slopes.	Well-drained soil from old alluvium in the uplands; medium internal drainage; lateral internal seepage; gravel makes up to 50 to 60 percent of lower horizon.	0–8	Loam
			8–26	Clay loam
			26–80+	Gravelly clay loam
Rs	Rough stony land.	A land type in steep, stony, forested uplands; sandstone at a depth of 5 to 14 inches; properties variable.		
RvC	Riverton gravelly loam, 3 to 5 percent slopes.	Well-drained soils from old alluvium in the uplands; medium internal drainage; lateral internal seepage; gravel beds at a depth of 12 to 22 inches.	0–16	Gravelly silt loam
			16–22	Gravelly clay loam
RvC2	Riverton gravelly loam, 3 to 5 percent slopes, eroded.		22–60	Gravelly clay loam
Sm	Strip mines.	A land type consisting of steep, irregularly sloping dumps of shale, sandstone, and soil material that have been mixed in strip mining coal; medium internal drainage; lateral internal seepage; properties variable.		

their estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic soil group
Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per inch of soil	*pH value*		
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CL	A-6	100	100	75-95	Moderately slow	.17	5.3	Moderate	
ML, CL	A-4	95-100	85-95	75-90	Moderate	.14	5.5	Low to moderate	D.
CL, CH	A-7	100	100	90-100	Very slow	.17	5.8	High	
ML, CL	A-4	90-100	90-100	55-85	Slow	.14	6.0	Low	B.
CL	A-6	90-100	85-95	75-95	Slow	.17	6.5	Moderate	
SM, SC	A-4	85-95	70-80		Slow	.12	7.0	Low	
SM	A-4	70-85	50-65	35-50	Moderate	.14	5.5	Low	C.
SM	A-4	60-70	45-50	40-50	Moderately slow	.12	5.5	Low	
SM	A-4		100	40-50	Moderate	.14	5.3	Low	B.
ML, CL	A-6, A-7		100	50-70	Moderately slow	.14	5.3	Moderate	
SM, SC	A-4, A-6		100	40-50	Moderately slow	.12	5.0	Low to moderate	
ML, CL	A-4	100	100	85-95	Moderate	.14	5.8	Low to moderate	B.
ML, CL	A-6, A-7	100	100	85-95	Moderate	.17	7.4	Moderate	
ML	A-4, A-6	100	100	85-95	Moderate	.17	6.0	Moderate	C.
MH	A-7	100	100	90-100	Slow	.17	6.0	High	
CH	A-7	100	100	90-100	Moderately slow	.17	6.5	High	
CL, CH	A-7	100	100	90-100	Very slow	.17	6.0	High	D.
ML, CL	A-4	100	100	75-90	Moderate	.14	5.4	Low to moderate	D.
CL, CH	A-7	100	100	90-100	Very slow	.17	5.7	High	
ML, CL	A-4	90-100	90-100	70-80	Moderate	.14	5.8	Low	C.
ML, CL	A-4	85-95	85-95	70-90	Moderately slow	.17	6.1	Moderate	
GC, GM	A-2	30-50	30-50	25-35	Moderate	.12	6.1	Low	
ML, CL	A-4	80-90	80-90	75-85	Moderate	.14	5.8	Low to moderate	B.
ML, CL	A-4	60-70	60-70	60-70	Moderate	.14	5.8	Low to moderate	
GP, GM	A-1, A-2	30-50	30-50	0-25	Moderately rapid	.12	5.8	Low	
							7.0		A.

TABLE 5.—*Brief description of soils of Rogers County and*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification
				USDA texture
			Inches	
So	Sogn soils.	Well-drained, very shallow, stony, soils from limestone; limestone at a depth of 6 to 12 inches.	0–8	Silty clay loam
SuB	Summit silty clay loam, 1 to 3 percent slopes.	Well-drained soils from limestone in the uplands; limestone at a depth of 2 to 6 feet; slow internal drainage; seasonally high water table at a depth less than 2 feet.	0–14	Silty clay loam
			14–22	Silty clay
SuC	Summit silty clay loam, 3 to 5 percent slopes.		22–47	Clay
SuC2	Summit silty clay loam, 1 to 5 percent slopes, eroded.			
TaA	Taloka silt loam, 0 to 1 percent slopes.	Somewhat poorly drained soil from old alluvium in the uplands; very slow internal drainage; seasonally high water table at a depth less than 20 inches.	0–22	Silt loam
			22–44+	Clay
Vd	Verdigris silt loam.	Deep, well-drained soil on bottom lands; medium internal drainage; subject to occasional flooding.	0–16	Silt loam
			16–50+	Heavy silt loam
Ve	Verdigris clay loam.	Deep, well-drained soil on bottom lands; slow internal drainage; subject to occasional flooding.	0–44	Silty clay loam
			44–54	Silty clay
Vf	Verdigris soils, frequently flooded.	Medium-textured soils on bottom lands; V-shaped channels and breaks in places; frequently flooded; properties are variable but are similar to those of Verdigris silt loam.		
WsA	Woodson and Summit soils, 0 to 1 percent slopes.	Woodson soils: Deep, somewhat poorly drained soil in the uplands; very slow internal drainage; seasonally high water table at a depth less than 1 foot.	0–14	Silty clay loam
			14–60+	Clay
		Summit soils: For description and estimated properties, see Summit silty clay loam, 1 to 3 percent slopes.		

TABLE 6.—*Engineering*

Soil series	Suitability as source of—			Soil features affecting—
	Topsoil	Select grading material	Road fill	Highway location
Bates (Bc, BdC2, DbC)	Surface soil good	Surface soil fair to good	Good	Sandstone and sandy shale bedrock at 2 to 3 feet; lateral seepage on slopes.
Choteau (ChB)	Good	Poor to fair; upper 2 feet suitable.	Good	Slow internal drainage
Claremore (CmB)	Total profile is good; lower horizon is granular clay.	Fair to poor; too plastic.	Good to fair; shallow to bedrock.	Gentle slopes; 1 to 2 feet to limestone.
Collinsville (Co, Bc)	Poor; limited quantity; stony in places.	Poor; material too rocky; amount limited.	Fair to good; shallow to bedrock.	Steep slopes; stony; seepage along bedrock.
Dennis (DbC, DnB, DnC, BdC2)	Surface soil good	Surface layer fair to good.	Fair	Gentle slopes; good surface drainage.
Dwight (DwA)	Poor; limited suitable material.	Poor; surface soil thin; subsoil too plastic.	Poor; highly plastic; high shrink-swell potential.	Poor internal and surface drainage.

their estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic soil group
Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per inch of soil	*pH value*		
CL	A-6, A-7	100	100	85–95	Moderately slow	0.17	8.0	Moderate	D.
ML, CL	A-7, A-6	100	100	85–95	Moderately slow	.17	7.0	Moderate	D.
MH, CH	A-7	100	100	90–100	Slow	.17	6.5	High	
CH	A-7	100	100	95–100	Slow	.20	7.0	High	
ML, CL	A-4	100	100	75–90	Moderate	.14	6.0	Low to moderate	D.
CL, CH	A-7	100	100	90–100	Very slow	.17	6.5	High	
ML, CL	A-4	100	90–100	90–100	Moderate	.14	6.3	Low to moderate	B.
ML, CL	A-6	100	90–100	75–90	Moderately slow	.17	6.4	Low to moderate	
ML, CL	A-7, A-6	100	100	90–100	Moderately slow	.17	6.0	Moderate	B.
CL	A-6	100	100	85–95	Moderately slow	.17	6.5	Moderate	
CL	A-7	100	100	90–100	Slow	.17	6.0	Moderate	D.
MH, CH	A-7	100	100	90–100	Very slow	.17	7.0	High	

interpretation of soils

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Limited depth to bedrock; high seepage.	Limited borrow material; variable seepage.	Well drained	Too shallow; irregular slope.	Soil properties favorable; generally no limitations.	Favorable.
Deep soil; low seepage.	Features favorable	Seasonally high water table; surface well drained.	Gently sloping; seasonally high water table.	Gently sloping	Features favorable.
Variable seepage; shallow to bedrock.	Limited borrow material; high seepage.	Well drained	Shallow	Shallow	Shallow; droughty.
Very shallow to bedrock; stony.	Limited borrow material; seepage along bedrock.	Nonarable	Nonarable	Nonarable	Nonarable.
Low seepage; seasonally high water table.	Features favorable	Surface well drained; seasonally high water table.	Gently sloping; seasonally high water table.	Features favorable	Features favorable.
Low seepage; seasonally high water table.	Highly plastic	Poor internal and surface drainage; seasonally high water table.	Level; very slow permeability; seasonally high water table.	Level; occasional slick spot.	Droughty; subject to cracking; slick spots; unstable.

TABLE 6.—*Engineering*

Soil series	Suitability as source of—			Soil features affecting—
	Topsoil	Select grading material	Road fill	Highway location
Hector (Hc, HIC)	Poor; too stony	Good; contains soft rock and boulders.	Good to fair; shallow to bedrock.	Steep slopes; stony; seepage along bedrock.
Linker (LkB, LkC, HIC)	Good	Good	Fair	Gentle slopes; well drained.
Newtonia (NaA, NaB)	Total profile is good; lower horizon is granular clay.	Fair to poor; too plastic.	Fair	Gentle slopes; deep soils.
Okemah (OkA, OkB, OkB2)	Poor; too clayey	Poor; too plastic	Fair to poor; highly plastic; high shrink-swell potential.	Poor internal drainage; seasonally high water table.
Osage (Os)	Poor; too clayey	Poor; highly plastic	Poor; highly plastic; high shrink-swell potential.	Highly plastic; poor drainage; subject to overflow.
Parsons (PaA)	Upper 12 inches good; subsurface unsuitable.	Poor; surface soil suitable but too shallow.	Poor; highly plastic; high shrink-swell potential.	Highly plastic; poor internal drainage; seasonally high water table.
Riverton (RmB)	Good	Good below 2 feet, or when total profile is mixed.	Good	Gentle slopes; well drained.
Sogn (So)	Poor; too thin and too clayey.	Fair; amount limited; too plastic.	Fair to poor	Very shallow to limestone bedrock; gentle to steep slopes.
Summit (SuB, SuC, SuC2; WsA).	Fair; granular clayey material.	Poor; too plastic	Poor; highly plastic; high shrink-swell potential.	Limestone bedrock at depth of 2 to 6 feet; highly plastic.
Taloka (TaA)	Good in upper 1½ to 2½ feet; subsoil poor.	Surface soil is good; subsoil is poor; too plastic.	Poor; top 2 feet moderately plastic; below 2 feet very plastic; high shrink-swell potential.	Poor internal drainage; level.
Verdigris:				
Verdigris clay loam (Ve)	Poor; too clayey	Poor; too plastic	Fair to good	Level; occasional flooding.
Verdigris silt loam (Vd)	Total profile good	Good for entire profile	Good	Level; occasionally flooded.
Verdigris soils frequently flooded (Vf).	Poor to fair; amount limited.	Fair to good; amount limited.	Fair; amount limited	Rough broken topography; frequently flooded.
Woodson (WsA)	Poor; highly plastic	Poor; highly plastic	Poor; highly plastic; high shrink-swell potential.	Highly plastic; poor internal drainage; seasonally high water table; level.

interpretation of soils—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
High seepage; shallow to bedrock.	High seepage; limited borrow material.	Excessively drained	Shallow; steep slopes	Shallow; steep slopes	Shallow; steep slopes; droughty.
Variable depth to soft limestone.	Features favorable	Well drained	Moderately sloping; all other features favorable.	Subject to gully erosion; other features favorable.	Subject to gully erosion.
Variable seepage; variable depth to bedrock.	Granular clay; difficult to compact; high seepage.	Well drained	Level to gently sloping.	Level to gently sloping.	Features favorable.
Deep soil; low seepage.	Poor stability; highly plastic material.	Surface well drained; seasonally high water table.	Level to gently sloping; seasonally high water table.	Level to gently sloping; occasional slick spots.	Slick spots; unstable; seasonally high water table.
Low seepage; deep, level soils.	Subject to severe cracking; low stability.	Very slow permeability; level to depressed topography; internal drainage poor; subject to flooding.	Very slow intake rate; subject to overflow; poorly drained.	Level; severe cracking.	Level; subject to cracking; subject to flooding.
Low seepage; variable depth to shale; level.	Low stability; subject to severe cracking.	Seasonally high water table; poor internal drainage; level.	Very slow intake rate; poor internal drainage.	Level; occasional slick spots.	Level; slick spots; unstable.
Gravelly subsoil; low drainage area; moderate seepage.	Very stable	Well drained	Variable topography; occurs in small areas.	Features favorable	Features favorable.
Very shallow to bedrock.	Low stability; limited borrow material.	Well drained; nonarable.	Very shallow; nonarable.	Nonarable	Nonarable; very shallow.
Moderate seepage; variable depth to bedrock.	Low stability; moderate seepage.	Seasonally high water table; surface well drained; poor internal drainage.	Slow internal drainage; moderately sloping.	Occasional slick spot; subject to cracking.	Slick spots; unstable; vegetation difficult to establish.
Low seepage; level	Low strength and stability; subject to cracking.	Seasonally high water table; poor internal drainage; depressed areas need drainage.	Slow intake rate; poor internal drainage.	Level	Level.
Variable seepage; level; stratified profile.	Level; other features favorable.	Depressed areas need drainage; occasional overflow.	Level; moderately slow intake rate; subject to flooding.	Level; subject to flooding.	Level; subject to flooding.
Variable seepage; level; stratified profile.	Level; other features favorable.	Well drained; occasional flooding.	Level; moderate intake rate; subject to flooding.	Level; subject to flooding.	Level; subject to flooding.
Frequently flooded; scour and sediment damage.	Rough topography; frequently flooded; variable stability.	Broken topography; frequently flooded.	Nonarable	Nonarable	Frequently flooded.
Low seepage; level	Low strength and stability; subject to severe cracking.	Very slow permeability; poor internal drainage; simple drainage needed.	Level; very slow intake rate.	Level; subject to cracking; occasional slick spot.	Level; droughty.

TABLE 7.—*Engineering*

Soil name and location	Parent material	Oklahoma report number	Depth	Horizon	Shrinkage		Volume change from field moisture equivalent
					Limit	Ratio	
			Inches				*Percent*
Bates loam, shallow phase:							
100 feet north of center of south side of sec. 1, T. 20 N., R. 16 E. (Modal).	Sandstone	SO-4363	0–12	A1	22	1.59	19
		SO-4364	12–16	B2	21	1.69	21
Linker fine sandy loam:							
SW corner of NW¼ sec. 34, T. 22 N., R. 17 E. (Modal).	Sandstone	SO-4351	5–16	A2	15	1.86	5
		SO-4352	16–28	B21t	14	1.88	50
		SO-4353	28–40	R	20	1.73	20
Newtonia silt loam:							
Center of west side of sec. 5, T. 21 N., R. 16 E. (Nonmodal).	Shale	SO-4370	0–12	A1	26	1.53	20
		SO-4371	12–19	B1	19	1.76	44
		SO-4372	19–32	B21	15	1.85	76
100 yards S. of NW corner of sec. 30, T. 22 N., R. 16 E. (Modal).	Limestone	SO-4365	0–5	Ap	19	1.74	16
		SO-4366	14–32	B2t	16	1.84	46
Okemah silty clay loam:							
Southeast corner of NE¼ SE¼ sec. 10, T. 19 N., R. 17 E. (Nonmodal).	Shale	SO-4360	0–12	A1	25	1.54	15
		SO-4361	16–22	B1	12	1.93	70
		SO-4362	38–60+	C	12	1.97	55
NE¼ SE¼ sec. 19, T. 21 N., R. 16 E. (Modal)	Shale	SO-4357	0–5	Ap	22	1.64	6
		SO-4358	23–34	B21t	13	1.92	62
		SO-4359	44–56+	C	12	1.96	62
Riverton loam:							
Center of NE¼ sec. 11, T. 21 N., R. 15 E. (Modal)	Alluvium	SO-4367	0–5	Ap	19	1.70	5
		SO-4368	16–32	B2t	18	1.78	19
		SO-4369	32–92	B3	17	1.80	21
Summit silty clay loam:							
45 feet NW of SE corner, sec. 3, T. 23 N., R. 15 E. (Modal).	Limestone	SO-4348	0–6	A1	16	1.76	50
		SO-4349	14–26	B21t	10	1.99	79
		SO-4350	48–60+	C	8	2.09	92
Verdigris clay loam:							
300 feet N. of SE corner, sec. 9, T. 20 N., R. 15 E. (Modal).	Alluvium	SO-4354	0–6	Ap	18	1.74	38
		SO-4355	17–26	A1	17	1.80	26
		SO-4356	44–54	C2	12	1.91	37

[1] Tests performed by the Oklahoma Department of Highways in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

Permeability relates only to the rate at which water moves downward through undisturbed materials. In the column showing permeability in table 5, the rate is estimated for soils as they occur in place. The ratings are based on soil structure and porosity. The adjective ratings assigned to each horizon are defined in terms of inches per hour in the Glossary. Mechanically developed plowpans, surface crusting, and other features caused by mechanical disturbance are not considered.

Available water capacity, reported in inches per inch of soil depth, refers to the approximate amount of capillary water in the soil when the soil is wet to field capacity. When the soil is air dry, the amount of water shown will wet the soil material described to a depth of 1 inch without deeper percolation.

In table 5 the column showing reaction indicates the estimated acidity or alkalinity of the soil. A convenient method of indicating soil reaction is by pH. A pH of 4.5 to 5.0 indicates that the soil is very strongly acid, and a pH of 9.1 or higher indicates the soil is very strongly alkaline.

Shrink-swell potential of soil material refers to the change in volume that results from a change in moisture content. In table 5 this potential is expressed as *low*, *moderate*, *high*, and *very high*. For example, Osage clay has a high shrink-swell potential because of its high content of clay.

test data.[1]

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						
1½-in.	¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
	100	98	95	88	78	60	18	14	32	6	A-4(8)	ML.
	100	94	89	82	73	62	21	17	33	8	A-4(8)	ML-CL.
			100	99	42	34	14	11	18	2	A-4(1)	SM.
				100	71	65	50	46	44	16	A-7-6(10)	ML-CL.
			100	98	50	48	33	28	34	9	A-4(3)	SM-SC.
			100	95	86	72	29	22	45	24	A-7-6(15)	CL.
100	97	97	96	93	86	76	43	36	45	12	A-7-5(10)	ML.
			100	99	95	88	65	58	69	30	A-7-5(20)	MH.
			100	99	93	78	29	23	28	6	A-4(8)	ML-CL.
			100	97	94	84	43	38	44	16	A-7-6(11)	ML-CL.
			100	98	92	79	28	21	38	10	A-4(8)	ML.
			100	99	96	88	57	51	59	26	A-7-5(18)	MH.
			100	99	94	86	50	44	53	28	A-7-6(18)	CH.
			100	99	89	76	21	17	30	6	A-4(8)	ML-CL.
			100	99	95	87	56	50	59	29	A-7-5(19)	MH-CH.
			100	99	93	85	51	44	54	28	A-7-6(18)	CH.
100	99	94	93	92	82	71	20	15	24	4	A-4(8)	ML-CL.
	100	96	94	93	83	78	28	22	29	8	A-4(8)	ML-CL.
100	87	41	36	34	31	27	11	8	31	10	A-2-4(0)	GM-GC.
				100	97	91	40	33	47	16	A-7-5(12)	ML.
				100	98	93	51	45	64	33	A-7-5(20)	MH-CH.
				100	98	94	54	47	67	41	A-7-6(20)	CH.
				100	98	94	47	36	46	17	A-7-6(12)	ML.
				100	98	90	31	25	36	14	A-6(10)	CL.
				100	91	82	37	30	37	16	A-6(10)	CL.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145-49. Oklahoma Department of Highways classification procedure further subdivides the AASHO A-2-4 subgroup into the following: A-2-3(0) when reading for the plasticity index (PI) indicates nonplastic (NP); A-2(0) when PI is NP to 5; and A-2-4(0) when PI is 5 to 10.

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953. SCS and BPR have agreed to consider that all soils having plasticity indexes within two points from the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this practice are SM-SC, ML-CL, and MH-CH.

A hydrologic grouping of soils is used along with other data to compute the amount of runoff from a watershed after a storm of some given or actual intensity and duration. Knowledge of soil profile characteristics has been used in placing the soils of the county into four hydrologic groups. The soils were grouped according to the system explained in the Soil Conservation Service Engineering Handbook, Supplement A, section 4. This system lists four hydrologic groups. The groups range from open sands (lowest runoff potential, group A) to tight clays (highest runoff potential, group D). The groupings express the intake of water at the end of storms during which soils have been made wet and have swelled. Also needed to compute the amount of runoff from a watershed are data on land use and treatment.

Table 6 shows specific features of soils that affect their use for engineering. These features may affect the selection of a site, the design of a structure, or the application of practices for land treatment. The data in this table are evaluated on the basis of (1) estimated data in table 5, (2) actual test data in table 7, and (3) field experience. The practices listed in table 6 are those common in the county. Ratings showing suitability of the soils as a source of material for various uses are given, and some of the related undesirable and desirable features are mentioned.

None of the soils in the county, except the Riverton soils, are a suitable source of gravel. The Riverton soils are suitable only at a depth below 26 inches.

Normally only the surface layer of a soil is rated for topsoil, since the suitability of a soil for topsoil material depends largely upon the texture and depth of the surface layer. Topsoil material must be capable of being worked into a good seedbed for seeding or sodding, yet be clayey enough to resist erosion when used on steep slopes. The depth of suitable material determines whether or not it is economical or wise to remove the material for use as topsoil.

None of the soils in the county are a suitable source of sand for engineering works.

The suitability of the soils for select grading material depends primarily upon the size of the particles and the kind of binding material that holds the particles together. If a binder is added for cohesion, soils that are primarily sands are rated as a good source of grading material. Clay soils compress under load but rebound when unloaded; thus, they are rated poor as a source of grading material.

Every kind of soil material is used in a road fill. Some soils, such as sandy clays and sandy clay loams, offer few problems in placement or compaction. Clays with a high shrink-swell potential require special compaction techniques and close moisture control during and after construction. Sands compact well but are difficult to confine if used in a fill. The ratings in table 6 reflect the ease with which these problems can be overcome.

In table 7 the results of tests conducted on nine samples from seven soil series are listed. The tests were conducted by the State of Oklahoma Department of Highways, Materials and Research Department, according to standard procedures of the American Association of State Highway Officials (AASHO). Seven of the soils sampled have modal profiles, and two have nonmodal profiles. A modal profile is the most typical one for that soil as it occurs in the county. A nonmodal profile is one that varies from the modal profile but is in the range allowed for that series.

The tests for liquid limit and plastic limit measure the effects of water on the consistence of the soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content, on a dry basis, at which the soil material changes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and plastic limit. It indicates the range of moisture content within which a soil material is plastic.

As moisture leaves a soil, the soil shrinks and decreases in volume in proportion to the loss of moisture. As the loss continues, a point is reached where shrinkage stops, even though additional moisture is removed. The moisture content at which shrinkage stops is the shrinkage limit of the soil and is reported as the moisture content in relation to the ovendry weight of soil at the point where shrinkage stops.

Since clay is the major soil fraction that causes shrinkage, the shrinkage limit of a soil is a general index of clay content and will, in general, be a low number for soils that contain much clay. The shrinkage limit of sands that contain little or no clay, however, is close to the liquid limit and is considered insignificant. The shrinkage limit of sands that contain some silt and clay ranges from about 14 to 25, and the shrinkage limit of clays ranges from about 9 to 14. As a rule, the load-carrying capacity of a soil is at the maximum when the moisture content is at or below the shrinkage limit. Sands do not follow this rule, because they have a uniform load-carrying capacity within a wide range of moisture content, providing they are confined.

The shrinkage ratio of a soil is the volume change, resulting from drying the soil material, divided by the loss of moisture caused by drying. Theoretically, it is also the apparent specific gravity of the dried soil pat.

Volume change from field moisture equivalent (FME) is defined as the volume change, expressed as a percentage of the dry volume of the soil mass, when the moisture content is reduced from the FME to the shrinkage limit. The FME is the minimum content of moisture at which a smooth surface of undisturbed soil will absorb no more water in 30 seconds, when the water is added in individual drops. It is the moisture required to fill all the pores in sands and to approach saturation in cohesive soils that have not been disturbed.

The engineering soil classifications in table 7 are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. Mechanical analyses were made by the combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method are not suitable for determining textural classes of soils used by the U.S. Department of Agriculture.

Formation, Classification, and Morphology of Soils

The relationship of the outstanding morphologic characteristics of the soils of Rogers County to the factors of soil formation is discussed in this section. Physical and chemical data are limited for these soils, and the discussion is correspondingly incomplete. Also in this section the soils are classified in higher categories, and their morphology, as shown by the soil profile, is given.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on parent materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent materials; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil formation have acted on the material.

Climate and vegetation are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and, in a period of time, change it into a natural body with genetically related horizons. The effects of climate and vegetation are condi-

tioned by relief. The parent material also affects the kind of profile that can be formed and, under extreme conditions, determines it almost entirely. Finally, time is needed to change the parent material into a distinct soil profile. It may be much or little, but some time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are not well known.

Parent material.—The soils in the uplands of Rogers County developed from sedimentary rock and shale laid down during the Pennsylvanian geologic age. These alternating beds of hard and soft material dip toward the west. The strike of the formation is northeast-southwest, which is reflected in the pattern of soils on the general soil map and in the courses of the Verdigris River and other streams in the eastern part of the county. The alluvial and low terrace soils along major streams were laid down during the Quaternary age.

The McAlester and Savanna formations are in the southeastern corner of the county at elevations that range from 570 to 620 feet above sea level. Soils in these areas are largely from shale. The Dennis, Okemah, and Parsons soils developed under prairie grasses from this material.

The Boggy shale formation is in the southeastern part of the county at elevations that range from 640 to 760 feet. Soils in this area are largely from Bluejacket sandstone. The Bates, Collinsville, and Dennis soils developed from this formation under prairie grasses.

In the east-central part of the county, a large area of the Senora formation is exposed at elevations that range from 620 feet on the Rogers-Wagoner county line to 850 feet in the northeastern corner of the county. This formation is made up of alternating beds of sandstone and shale. The soils that developed from areas of exposed shale under prairie grasses were mainly the Dennis, Okemah, and Parsons. The soils that developed from areas of exposed sandstone under sparse stands of trees were the Hector and Linker. These areas are generally hilly and rough.

The Fort Scott limestone formation crops out along the eastern side of the Verdigris River and extends through the central part of the county. The Newtonia, Claremore, Summit, and Sogn soils developed under prairie grasses from this limestone.

Labette shale is exposed along the western side of the Fort Scott limestone. In this shale the Verdigris River has cut its channel and flood plain from the north end of the county southwestward to Catoosa, where it turns sharply to the east. Most of the shale now exposed makes up a large part of the escarpment along the western side of the Verdigris River. This escarpment is mapped as Rough stony land.

The Oologah and Lenapah limestone formations are exposed in broad areas along the western side of and parallel to the Verdigris River. Elevations range from 600 to 872 feet. The Summit, Sogn, Newtonia, and Claremore soils formed under prairie grasses from these formations.

The Nowata shale, Holdenville shale, and Seminole formation are exposed in the northwestern part of the county at elevations ranging from 620 to 700 feet. The Dennis, Okemah, Woodson, and Parsons are the major soils in this broad, gently rolling valley. The Coffeyville formation is exposed in the extreme northwest corner of the county at elevations ranging from 700 to 850 feet. It consists of alternating beds of sandstone and shale and has rolling relief and a cover of prairie grasses. The major soils are the Bates, Collinsville, and Dennis.

The county has about 28,000 acres of terrace deposits on nearly level benches along the larger streams. The major soils formed on the terraces are the Choteau, Taloka, Riverton, Okemah, and Parsons. The bottom lands along the larger streams range from 1 to 4 miles in width and consist of Verdigris and Osage soils.

Plant and animal life.—Plants and animals living on or in the soil affect its chemical composition and structure and hasten soil formation. They provide organic matter, which improves soil structure.

Vegetation provides a protective cover and shade for the soil, which reduces the loss of water from runoff, wind, and heat. Plant roots help to keep the surface layer supplied with nutrients by bringing up minerals from the parent material. Plant residue and channels made by plant roots greatly influence soil development.

The original vegetation covering most of the county consisted of tall native grasses, mainly big bluestem, little bluestem, indiangrass, and switchgrass. The Dog Creek Hills and part of the bottom lands were covered with forests consisting mainly of oak, hickory, and elm.

The principal types of vegetation in the county now are tall native grasses (see fig. 17 p. 29) and hardwood trees (see fig. 21 p. 33). The fibrous roots of the grasses are near the surface and help to restrict the deep leaching of minerals. The soils on prairies are generally high in organic matter. The leaves from the oak-hickory forest cause an acid reaction. The Hector and Linker soils, which developed under trees, are acid and have a highly leached A2 horizon.

Climate and soil formation.—Rogers County has a temperate, continental climate. It is subhumid but it borders on the humid type that occurs to the east of the county. The county is a transitional area subject to rapid and significant variations of temperature, precipitation, cloudiness, and wind. The winters are mild most of the time, as cold periods usually last only a few days. The spring season is accompanied by variable weather; it is the period of the greatest seasonal rainfall and the most severe storms. Summers are usually hot but have good breezes and occasional heavy showers. Autumn usually has longer periods of mild, sunny days and only occasional showers.

The variation in weather from season to season is favorable to the soil-forming processes. The temperature extremes have ranged from 116° F. to −21°. Freezing temperatures occur on an average of 82 days a year, but on only about 7 days a year does the temperature fail to rise above freezing. The hottest summer was in 1936 when there were temperatures of 100° or higher on 70 days. On an average of 15 days a year, temperatures of 100° or higher have been recorded. The freezing, thawing, and drying of the soils hasten soil formation.

The average annual precipitation in Rogers County is 38.08 inches. The annual precipitation ranges from 24.21 inches to 62.48 inches. Heavy 24-hour precipitation of 3 to 7 inches has been recorded in all months except February and November. Because of the intensity and amount of rainfall, erosion and leaching are very active. On

steeper slopes, erosion prevents soil development and only young soils, such as Collinsville and Sogn, have formed.

Relief.—Most of the county has a moderately uneven surface. The succession of valley plains and moderately rounded hills are the result of erosion on westward-dipping strata of alternating beds of hard and soft rocks. Erosion has reduced the soft strata to moderately broad valleys that have long gentle slopes that dip westward and steep east-facing escarpments. The most prominent escarpment is along the west side of the Verdigris River. There is a hilly area in the northeastern part known locally as Dog Creek Hills and another rough area between Sageeyah and Talala.

Time.—The length of time required for soil to develop depends on the combined action of the other four soil-forming factors. If the factors of soil formation have not acted long enough to allow definite horizons to form, the soil is said to be immature, or young. Examples of immature soils in Rogers County are the Sogn, Collinsville, Verdigris, and Osage.

Soils that have been in place for a long time, that have approached equilibrium with their environment, and that have well-defined horizons are said to be mature. Many of the soils of Rogers County that are mainly in nearly level to gently sloping areas have well-defined horizons and are mature. The Dwight, Parsons, Taloka, Choteau, Dennis, Okemah, and Linker are mature soils.

Classification and Morphology of Soils

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms, ranches, or counties. They are placed in broad classes for study and comparisons of large areas such as continents. In the comprehensive system of soil classification followed in the United States, the soils are placed in six categories. Beginning with the highest, the six categories are order, suborder, great soil group, family, series, and type.

In the highest category, the soils of the whole country are grouped into three orders; in the lowest category, thousands of soil types are recognized in the United States. The suborder and family categories have never been fully developed and thus have been little used. Most attention has been given to the classification of soils into soil types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups. Subdivisions of soil types into phases provide finer distinctions significant to use and management.

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders. The zonal order consists of soils with evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. In Rogers County the great soil groups in the zonal order are Brunizems, Reddish Prairie soils, and Red-Yellow Podzolic soils.

In the intrazonal order are soils with evident, genetically related horizons that reflect the dominant influence of topography or parent materials over the effects of climate and living organisms. In Rogers County only Planosols are in the intrazonal order.

The azonal order consists of soils that lack distinct, genetically related horizons, commonly because they are young, have resistant parent materials, or are on steep slopes. In Rogers County the great soil groups in the azonal order are Alluvial soils and Lithosols.

In table 8 the soil series are listed by great soil groups and important characteristics of each series are given. In the following pages each great soil group represented in Rogers County is described. Also described is a profile representative of each series. Unless otherwise stated, the description is that of a dry soil.

Brunizems

The Brunizems are a group of zonal soils that are in the central part of the United States. These soils have formed under tall prairie grasses in a fairly humid, temperate climate. Typically, Brunizems have an acid, thick, very dark brown to black A horizon rich in organic matter; a brown B horizon that may or may not be mottled; and lighter colored parent material.

In this county the parent materials of the Brunizem soils are mainly weathered from shale, sandstone, or limestone, but they may be from reconsolidated alluvium and loess.

In Rogers County the Bates, Choteau, Dennis, Okemah, Summit, and Woodson soils are in the Brunizem great soil group.

Bates series.—The Bates series consists of deep, medium-textured, moderately sloping, well-drained soils in the uplands. They developed under tall prairie grasses from noncalcareous sandstone and interbedded shales of Pennsylvanian age.

The Bates soils are associated with the Dennis and Collinsville soils. The Bates soils are somewhat coarser textured throughout their profile and are more permeable than the Dennis soils. They are deeper than the Collinsville soils, which are Lithosols.

Profile of Bates loam, 2 percent slopes, in native pasture 1,000 feet east and 50 feet north of southwest corner of sec. 20, T. 20 N., R. 17 E.—

A1—0 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; hard when dry, friable when moist; pH 5.6; gradual boundary.

A3—10 to 16 inches, brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; hard when dry, friable when moist; pH 5.2; gradual boundary.

B2t—16 to 30 inches, yellowish-brown (10YR 5/4) light clay loam with few, fine mottles of yellowish red; dark yellowish brown (10YR 4/4) when moist; moderate, fine, subangular blocky structure; thin, patchy clay films; hard when dry, moderately firm when moist; fine black concretions as much as ¼ inch in diameter and 5 percent by volume; pH 5.0; gradual boundary.

B3—30 to 36 inches, mottled light yellowish-brown and reddish-yellow light clay loam; weak, medium, subangular blocky structure; thin, patchy clay films; hard when dry, moderately firm when moist; pH 5.0; clear boundary.

R—36 inches +, yellowish-brown sandstone.

The texture of the A horizon in most places is loam, but in some it is heavy fine sandy loam. The color of the A horizon ranges from grayish brown to brown. The texture of the B horizon in most places is light clay loam but ranges from heavy loam to sandy clay loam. Depth to sandstone bedrock ranges from 24 to 50 inches. Slopes commonly range from 3 to 5 percent.

TABLE 8.—*Soil series classified by higher categories and some of the factors that have contributed to their morphology*

Great soil group and soil series	Parent material	Drainage and position	Native vegetation
ZONAL			
Brunizems:			
Bates	Sandstone and shale	Well drained; moderately sloping uplands	Tall grasses.
Choteau	Loamy alluvium	Moderately well drained; gently sloping terraces	Tall grasses.
Dennis	Acid shale and sandstone	Moderately well drained; gently and moderately sloping uplands.	Tall grasses.
Okemah	Shale	Moderately well drained; gently and moderately sloping uplands.	Tall grasses.
Summit	Limestone and calcareous shale.	Moderately well drained; gently and moderately sloping uplands.	Tall grasses.
Woodson	Clayey shale	Imperfectly drained; level uplands	Tall grasses.
Reddish Prairie:			
Claremore	Limestone and calcareous shale.	Well drained; gently sloping uplands	Tall grasses.
Newtonia	Limestone and calcareous shale.	Well drained; gently sloping uplands	Tall grasses.
Riverton	Loamy, gravelly alluvium	Well drained; moderately sloping terraces	Tall grasses.
Red-Yellow Podzolic:			
Linker	Sandstone	Well drained; gently and moderately sloping uplands.	Oak-hickory woodland.
INTRAZONAL			
Planosols:			
Dwight	Shale	Poorly drained; level uplands	Mid and tall grasses.
Parsons	Loamy alluvium	Somewhat poorly drained; level uplands	Tall grasses.
Taloka	Loamy alluvium	Somewhat poorly drained; level terraces	Tall grasses.
AZONAL			
Alluvial soils:			
Osage	Clayey alluvium	Poorly drained; level bottom lands	Oak-hickory woodland.
Verdigris	Loamy alluvium	Well drained; level bottom lands	Oak-hickory woodland.
Lithosols:			
Collinsville	Sandstone	Excessively drained; steep uplands	Tall grasses.
Hector	Sandstone	Well drained and excessively drained; moderately steep to steep uplands.	Oak-hickory woodland.
Sogn	Limestone	Well drained; moderately sloping to strongly sloping uplands.	Tall grasses.

Choteau series.—The Choteau series consists of deep, medium-textured, gently sloping, slowly permeable soils in the uplands. They developed under tall prairie grasses in old alluvium or valley fill in broad, nearly level valleys. Choteau soils are characterized by very thick horizons. They have a light-colored A2 horizon that grades to a much mottled, yellowish, slowly permeable B horizon.

The Choteau soils are associated with the Taloka, Riverton, and Dennis soils. The Taloka soils are Planosols. The Choteau soils are less red than the Riverton and have a light colored A2 horizon. Also, Choteau soils do not have beds of gravel in their lower horizons. They generally have thicker horizons than the Dennis soils and have an A2 horizon.

Profile of Choteau silt loam on 1 percent slopes in tame pasture 6 miles northwest of Inola at the center of the west side of sec. 26, T. 20 N., R. 16 E.—

A1—0 to 16 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; pH 5.3; clear boundary.

A2—16 to 26 inches, pale-brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) when moist; few dark-brown stains and concretions; weak, fine, granular structure; friable when moist, slightly hard when dry; pH 5.3; gradual boundary.

B1—26 to 32 inches, very pale brown (10YR 7/4) heavy silt loam, yellowish brown (10YR 5/4) when moist; few, fine, faint mottles of strong brown (7.5YR 5/8), and few black concretions; weak, fine, granular structure; friable when moist, slightly hard when dry; pH 5.0; gradual boundary.

B21t—32 to 40 inches, very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) when moist; many, medium, distinct mottles of reddish yellow (7.5YR 6/6) and yellowish red (5YR 5/6); weak, fine, subangular blocky structure; firm when moist, hard when dry; pH 5.5; gradual boundary.

B22t—40 to 60 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) when moist; many, medium, distinct and prominent mottles of red (2.5YR 5/8), yellow (10YR 7/8), and grayish brown (10YR

5/2); weak, fine, subangular blocky structure; firm when moist, hard when dry; pH 6.0; gradual boundary.

B3—60 to 72 inches +, coarsely mottled light yellowish-brown (10YR 6/4) and light-gray (10YR 7/1) silty clay loam; moderate, medium, subangular blocky structure; firm when moist, hard when dry; pH 6.0.

The color of the A1 horizon ranges from grayish brown to dark brown. The thickness of the A horizon ranges from 20 to 32 inches and averages about 26 inches. The texture of the B2 horizon ranges from clay loam to silty clay loam. The slopes range from 1 to 3 percent and average about 2 percent.

Dennis series.—In the Dennis series are deep, medium-textured, well-drained soils in gently sloping to moderately sloping uplands. These soils developed under tall prairie grasses, largely from noncalcareous shale and sandstone of Pennsylvanian age.

The Dennis soils are associated with Bates, Choteau, Okemah, and Parsons soils. They are finer textured throughout the profile and are less permeable than the Bates soils. The Dennis soils have thinner A and B horizons than the Choteau soils and do not have an A2 horizon. The Dennis soils are more acid and are slightly less dark and clayey than the Okemah soils. The Parsons soils are Planosols.

Profile of Dennis silt loam, 3 to 5 percent slopes, in native pasture on the south side of Oklahoma State Highway No. 88, near center of southwest quarter of sec. 7, T. 20 N., R. 16 E.—

A1—0 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; friable when moist, slightly hard when dry; pH 6.0; clear boundary.

B1—14 to 18 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark grayish brown (10YR 3/2) when moist; few dark concretions; moderate, medium, granular structure; friable when moist, slightly hard when dry; pH 5.5; clear boundary.

B21—18 to 28 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) when moist; many, medium, distinct mottles of yellowish red (5YR 4/6) and brownish yellow (10YR 6/6); many dark concretions; strong and moderate, medium, subangular blocky structure; firm when moist, hard when dry; pH 5.3; gradual boundary.

B22—28 to 34 inches, mottled light-gray (10YR 7/1), strong-brown (7.5YR 5/6) and red (2.5YR 4/6) heavy clay loam; moderate, blocky structure; firm when moist, very hard when dry; pH 5.3; gradual boundary.

C—34 to 50 inches, yellowish-brown (10YR 5/8) heavy clay loam, dark yellowish brown (10YR 4/8) when moist; massive (structureless); many dark concretions and fragments of shale; many, medium, distinct mottles of brownish yellow (10YR 6/6); very firm when moist, very hard when dry; pH 5.5.

R—50 inches +, shale and sandstone.

The color of the A horizon ranges from grayish brown to very dark brown. The thickness ranges from 10 to 16 inches but averages about 12 inches. The texture of the B horizon ranges from heavy clay loam to light clay. The depth to shale or sandstone ranges from 36 to 60 inches. The slopes range from 2 to 5 percent but average about 3 percent.

Okemah series.—The Okemah series consists of deep, dark-colored, moderately fine textured, moderately well drained soils in nearly level to moderately sloping uplands. These soils developed under tall prairie grasses from material that weathered from clayey shales of Pennsylvanian geologic age.

The Okemah soils are associated with the Dennis, Parsons, Taloka, and Woodson soils. They have a darker, finer textured, and less acid A horizon than the Dennis soils and darker and less acid B and C horizons. The Okemah soils have a darker and less acid A horizon than the Parsons and Taloka and have a more permeable and less acid B horizon. The A and B horizons of the Okemah soils are more permeable than those of the Woodson soils.

Profile of Okemah silty clay loam, 1 to 3 percent slopes, in native grass pasture, at the center of the south side of sec. 18, T. 20 N., R. 17 E.—

A1—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; few shale fragments and dark concretions; moderate, medium, granular structure; firm when moist, hard when dry; pH 6.0; clear boundary.

A3—8 to 14 inches, dark-gray (10YR 4/1) silty clay loam, very dark grayish brown (10YR 3/2) when moist; few, fine, faint mottles of dark brown (7.5YR 4/4); thin gray coatings on surface of peds; strong, medium, granular structure; firm when moist, hard when dry; pH 6.5; clear boundary.

B1—14 to 18 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; few, fine, faint mottles of light yellowish brown (10YR 6/4) strong, medium, granular to weak, subangular blocky structure; pH 6.5; clear boundary.

B21t—18 to 25 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) when moist; common, fine, faint mottles of brownish yellow (10YR 6/8); many dark concretions; weak, blocky structure; very firm when moist, very hard when dry; pH 6.5; gradual boundary.

B22t—25 to 35 inches, dark yellowish-brown (10YR 4/4) clay (10YR 3/4) when moist; common, fine, faint mottles of strong brown (7.5YR 5/8); many dark concretions; strong, medium, blocky structure; firm when moist, hard when dry; pH 7.0; gradual boundary.

C—35 to 45 inches +, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) when moist; common, medium, faint mottles of yellowish brown (10YR 5/8) and pale brown (10YR 6/3); many dark concretions; many gypsum crystals; massive (structureless); very firm when moist, very hard when dry; pH 8.0.

The color of the A horizon ranges from very dark gray to dark grayish brown. The texture ranges from heavy silt loam to silty clay loam. Gypsum crystals are not present in the C horizon in all places. Depth to shale or sandstone ranges from 36 to 82 inches. The slopes range from less than 1 to 5 percent and average about 2 percent.

Summit series.—The Summit series consists of deep, moderately fine textured, well-drained, gently sloping and moderately sloping soils in the uplands. They developed under tall prairie grasses from Pennsylvanian limestone and soft calcareous shale.

The Summit soils are associated with the Newtonia, Sogn, and Woodson. They are much darker than the Newtonia soils. They have a darker, deeper, and more granular A horizon than the Woodson soils and have a B1 horizon. The Summit soils are much deeper than the Sogn soils and have well-developed horizons.

Profile of Summit silty clay loam on 2 percent slopes in a native grass meadow 2 miles west of Catoosa near the

center of the northwest quarter of sec. 26, T. 20 N., R. 14 E.—

A1—0 to 14 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium and coarse, granular structure; friable when moist; roots abundant; pH 7.0; clear boundary.

B1—14 to 22 inches, dark-gray (10YR 4/1) light silty clay, very dark grayish brown (10YR 3/2) when moist; strong, medium and fine, granular structure; firm when moist, hard when dry; pH 6.5; gradual boundary.

B2t—22 to 36 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; common, fine, distinct mottles of dark gray (2.5Y 4/0) and dark grayish brown (2.5Y 4/2); moderate, fine, blocky structure; very firm when moist, very hard when dry; pH 7.0; gradual boundary.

C—36 to 47 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; many, fine, distinct mottles of gray (2.5Y 5/0) and light olive brown (2.5Y 5/4); massive (structureless); firm when moist, hard when dry; many small concretions of calcium carbonate; pH 7.0 or higher.

The thickness of the A horizon ranges from 12 to 18 inches and averages about 15 inches. The depth to bedrock or shale ranges from 30 to 70 inches. The slopes range from 1 to 5 percent.

Woodson series.—The Woodson series consists of deep, moderately fine textured, level, very slowly permeable soils in the uplands. They developed under tall prairie grasses in material that weathered from clayey shale of Pennsylvanian geologic age.

The Woodson soils are associated with Parsons, Okemah, and Summit soils. They have a darker B horizon than the Parsons soils and lack the A2 horizon of those soils. The Woodson soils are finer textured and have a darker B horizon than the Okemah soils and lack A3 and B1 horizons.

Profile of Woodson silty clay loam on a slope of ½ percent in native grass pasture, 4 miles west of Talala and 580 feet west and 310 feet north of the southeast corner of sec. 26, T. 24 N., R. 14 E.—

A1—0 to 10 inches, gray (10YR 5/1) light silty clay loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure: hard when dry, friable when moist; pH 5.5; clear boundary.

B2t—10 to 30 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak, fine, blocky structure; very compact; extremely hard when dry, extremely firm when moist; pH 6.0; diffuse boundary.

B3—30 to 48 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; few, fine, faint yellowish-brown mottles; very weak, blocky structure; extremely hard when dry, extremely firm when moist; small nests of white crystals; few, fine, black concretions; pH 6.5; gradual boundary.

C—48 to 60 inches +, gray (2.5Y 5/0) clay, dark gray (2.5Y 4/0) when moist; many, coarse, distinct, yellowish-red mottles; massive (structureless); extremely hard when dry, extremely firm when moist; pH 7.0.

The thickness of the A horizon ranges from 6 to 14 inches; the color ranges from gray to dark gray. The structure of the B horizon ranges from weak blocky to nearly massive. Depth to beds of shale or clay ranges from 36 inches to 5 feet or more.

Reddish Prairie soils

The Reddish Prairie soils are a zonal group of soils that are mostly in the southern part of the United States. The soils have formed under tall and mid prairie grasses in a humid to subhumid, warm-temperate climate.

Reddish Prairie soils generally have a dark reddish-brown, slightly acid to medium acid surface soil. Their subsoil grades through somewhat finer textured reddish material to the parent material. Depth to the parent material is between 2 and 5 feet.

In Rogers County the Claremore, Newtonia, and Riverton soils are in the Reddish Prairie great soil group.

Claremore series.—In the Claremore series are moderately deep, medium-textured, well-drained soils in the uplands. They developed under tall prairie grasses in material that weathered from limestone.

The Claremore soils are associated with the Newtonia and Sogn soils. They have thinner horizons and are less deep than the Newtonia soils. They are deeper than the Sogn soils and have well-developed horizons.

Profile of Claremore silt loam on a slope of ½ percent in a cultivated field 1,320 feet east of southwest corner of sec. 4, T. 21 N., R. 15 E.—

A1—0 to 10 inches, reddish-brown (5YR 4/3) heavy silt loam, dark reddish brown (5YR 3/3) when moist; strong, medium, granular structure; friable when moist, slightly hard when dry; few cherty limestone fragments; few dark concretions; pH 6.0; clear boundary.

B1—10 to 16 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) when moist; strong, medium granular structure to coarse, granular structure; firm when moist, hard when dry; many, small, cherty limestone fragments; pH 6.0; gradual boundary.

B2—16 to 22 inches, reddish-brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) when moist; strong, coarse, granular structure to fine, subangular blocky structure; many cherty limestone fragments; pH 6.0.

R—22 inches +, limestone bedrock.

The depth to limestone bedrock ranges from 18 to 28 inches. The color of the A horizon ranges from dark grayish brown to reddish brown, and the texture ranges from silt loam to heavy silt loam. The color of the B horizon ranges from dark grayish brown to red, and the texture from silty clay loam to clay loam.

Newtonia series.—The Newtonia series consists of deep, medium-textured, well-drained soils in the uplands. These soils developed under tall prairie grasses in material that weathered from limestone or calcareous shale.

The Newtonia soils occur in association with the Claremore, Summit, and Sogn soils. They are deeper and have thicker B and C horizons than the Claremore soils. They are redder than the Summit soils, and their B and C horizons are more friable. Newtonia soils are much deeper than the Sogn soils and they have well-developed horizons.

Profile of Newtonia silt loam, 0 to 1 percent slopes, 4 miles northwest of Claremore in a cultivated field in the northwest corner of sec. 30, T. 22 N., R. 16 E.—

Ap—0 to 6 inches, reddish-brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; pH 5.8; clear boundary.

A1—6 to 14 inches, reddish-brown (5YR 4/3) heavy silt loam; strong, medium and coarse, granular structure; friable when moist, slightly hard when dry; pH 6.0; clear boundary.

B1—14 to 20 inches, reddish-brown (5YR 4/4) light silty clay loam, dark reddish brown (5YR 3/4) when moist; strong, medium and coarse, granular structure; firm

when moist, hard when dry; few dark concretions; pH 5.8; gradual boundary.

B2t—20 to 32 inches, red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) when moist; weak, medium, subangular blocky structure; firm when moist, hard when dry; pH 5.8; clear boundary.

C—32 to 38 inches, red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) when moist; weak, medium, blocky structure; firm when moist, hard when dry; few cherty limestone fragments; pH 5.5.

R—38 inches +, limestone bedrock.

The texture of the the A horizon ranges from silt loam to heavy silt loam and the color from dark brown to reddish brown. The B horizon ranges from reddish brown to red. The depth to limestone or shale ranges from 24 to 74 inches.

Riverton series.—The Riverton series consists of deep, medium-textured, moderately sloping, well-drained soils on high alluvial terraces. These soils developed under tall prairie grasses in old alluvium. They are medium acid.

The Riverton soils are associated with Choteau soils. They have redder and more permeable B and C horizons than the Choteau soils and lack an A2 horizon.

Profile of Riverton loam on 2 percent slopes in a tame pasture 3 miles west of Inola and 600 feet south of northeast corner of sec. 2, T. 19 N., R. 16 E.—

A1—0 to 8 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; pH 5.8; clear boundary.

B1—8 to 16 inches, red (2.5YR 4/6) light clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; pH 5.8; gradual boundary.

B2t—16 to 26 inches, red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) when moist; firm when moist, hard when dry; pH 6.1; gradual boundary.

B3—26 to 40 inches, red (2.5YR 5/6) gravelly clay loam, red (2.5YR 4/6) when moist; structure obscured by abundance of chert gravel and dark concretions; firm when moist, hard when dry; pH 6.1; gradual boundary.

C—40 to 80 inches +, red (2.5YR 5/8) gravelly clay loam, red (2.5YR 4/8) when moist; rounded, waterworn chert gravel 50 percent by volume; pH 6.1.

The texture of the A horizon ranges from fine sandy loam to silt loam. The depth to gravel ranges from 26 to 48 inches but averages about 36 inches. The slopes range from 1 to 4 percent and average about 2 percent.

Red-Yellow Podzolic soils

The Red-Yellow Podzolic soils belong to the zonal order. These soils have formed under forest in a humid, warm-temperate climate. They have a thin surface layer of litter and acid humus and a thin organic-mineral A1 horizon over a thicker, light-colored, leached A2 horizon. The B horizon is a thick, red, yellowish-red, or yellowish-brown layer that has some accumulation of clay and sesquioxides. The C horizon is fairly siliceous.

In Rogers County the Linker are the only soils in the Red-Yellow Podzolic great soil group.

Linker series.—The Linker series consists of deep, moderately coarse textured, well-drained, gently sloping or moderately sloping soils in the uplands. These soils developed under trees from sandstone of Pennsylvanian geologic age. The Linker soils are characterized by a brownish A1 horizon over a lighter A2 leached horizon that grades to a yellowish-red and reddish-yellow sandy clay loam B horizon.

The Linker soils are associated with the Hector soils, which are Lithosols.

Profile of Linker fine sandy loam, 1 to 3 percent slopes, in woodland pasture near the center of the west side of sec. 34, T. 23 N., R. 17 E.—

A1—0 to 5 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; very friable when moist, soft when dry; well worked by roots; pH 5.3; clear boundary.

A2—5 to 16 inches, pale-brown (10YR 6/3) fine sandy loam, yellowish brown (10YR 5/4) when moist; weak, fine, granular structure; very friable when moist, soft when dry; few dark concretions; well worked by roots; pH 5.3; clear boundary.

B21t—16 to 28 inches, yellowish-red (5YR 5/6) sandy clay loam (5YR 4/6) when moist; many, medium, prominent mottles of yellowish brown (10YR 5/8), reddish brown (5YR 4/4), and reddish yellow (5YR 6/8); weak, medium, subangular blocky structure; firm when moist, hard when dry; few dark concretions; well worked by roots; pH 5.0; clear boundary.

B22t—28 to 40 inches, reddish-yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) when moist; many, coarse, distinct mottles of very pale brown (10YR 7/4) and red (2.5YR 4/6); strong, medium, subangular blocky structure; firm when moist, hard when dry; few dark concretions; few fragments of sandstone; pH 5.6.

R—40 inches +, soft, coarse-grained sandstone.

The color of the A1 horizon ranges from brown to grayish brown. The depth to sandstone bedrock ranges from 24 to 72 inches. The slopes range from 1 to 6 percent and average about 3 percent.

Planosols

The Planosols belong to the intrazonal order. These soils have one or more horizons that are abruptly separated from and are in sharp contrast to an adjacent horizon. The contrast may result from the high clay content, cementation, or compactness. Some Planosols have B horizons that are very high in clay beneath A horizons that are low in clay, the two horizons being separated by an abrupt boundary. Other Planosols have a fragipan—a compact, or brittle, seemingly cemented horizon—below a B horizon that has some clay accumulation.

In Rogers County the Dwight, Parsons, and Taloka soils are in the Planosol great soil group.

Dwight series.—The soils of the Dwight series are characterized by a shallow silt loam surface layer 4 to 6 inches thick over a very dense claypan B horizon that is very slowly permeable. The soils developed under mixed prairie grasses in clayey shale.

The Dwight soils are associated with the Parsons and Woodson soils. They have a thinner A1 horizon and lack an A2 horizon. They are lighter colored and have a thinner A horizon than the Woodson soils.

Profile of Dwight silt loam, 0 to 1 percent slopes, in tame pasture 200 yards west of the northeast corner of sec. 24, T. 23 N., R. 17 E.—

A1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; pH 5.5; abrupt boundary.

B2—6 to 30 inches +, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; weakly mottled with light gray and strong brown; weak, coarse, blocky structure; clay films on peds;

grayish silt film around blocks in upper part; very firm when moist, very hard when dry; pH 5.8.

The thickness of the A horizon ranges from 3 to 6 inches, and the texture ranges from silt loam to light silty clay loam.

Parsons series.—The Parsons series consists of deep, medium-textured, nearly level, very slowly permeable soils in the uplands. They developed under tall prairie grasses in old alluvium or valley fill in broad valleys. They are characterized by a light-colored A2 horizon over a brownish claypan B2 horizon.

The Parsons soils are associated with the Dwight, Taloka, Okemah, and Dennis soils. The Parsons have a thicker A1 horizon than the Dwight soils and have a light-colored A2 horizon that is lacking in Dwight soils. They have thinner A1 and A2 horizons and a browner B horizon than the Taloka soils. Unlike the Okemah and Dennis soils, the Parsons soils have a light-colored A2 horizon. Also, they have a finer textured and more slowly permeable B horizon than the Okemah and Dennis.

Profile of Parsons silt loam, 0 to 1 percent slopes on east side of U.S. Highway 66 in native meadow in the southeast corner of sec. 15, T. 23 N., R. 17 E.—

A1—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; pH 6.5; clear boundary.

A2—8 to 11 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; pH 5.4; abrupt boundary.

B21t—11 to 24 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; few, fine, distinct mottles of dark reddish brown (2.5YR 3/4) and yellowish brown (10YR 5/4) when moist; gray silt films on side of some peds; weak, medium and coarse, blocky structure; very firm when moist, very hard when dry; pH 5.7; gradual boundary.

B22t—24 to 40 inches, light yellowish-brown (10YR 6/4) clay, yellowish brown (10YR 5/4) when moist; many, medium, distinct mottles of red (2.5YR 4/6) and dark grayish brown (10YR 4/2) when moist; weak, coarse, blocky structure; very firm when moist, very hard when dry; pH 6.1; gradual boundary.

C—40 to 52 inches +, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) when moist; many, medium, distinct mottles of light gray (10YR 7/2) and brownish yellow (10YR 6/8) when moist; massive (structureless); gypsum crystals in the lower part; pH 7.0.

The thickness of the A1 and A2 horizons together ranges from 8 to 16 inches, and the color ranges from grayish brown to dark grayish brown. Depth to shale or sandstone ranges from 34 to 94 inches.

Taloka series.—The Taloka series consists of deep, medium-textured, very slowly permeable soils in the uplands. These soils developed under tall prairie grasses in old alluvium or valley fill in broad, nearly level valleys. They are characterized by having very thick horizons, particularly a thick, light-colored A2 horizon over a claypan B2 horizon.

The Taloka soils are associated with the Parsons, Choteau, and Okemah soils. They differ from Parsons soils mainly in having thicker A1 and A2 horizons. They have darker, finer textured, and less permeable B horizons than the Choteau soils. The Taloka soils have a lighter colored A1 horizon, a coarser textured A2 horizon, and a finer textured and less permeable B horizon than the Okemah soils.

Profile of Taloka silt loam, 0 to 1 percent slopes, in native meadow, 1,320 feet west of southeast corner of sec. 17, T. 19 N., R. 17 E.—

A1—0 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; roots abundant; pH 6.0; gradual boundary.

A2—12 to 22 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/2) when moist; weak, fine, granular structure; friable when moist; pH 6.0; abrupt boundary.

B21t—22 to 30 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; many, medium, distinct mottles of yellowish brown (10YR 5/8) and dark red (2.5YR 3/6) when moist; weak, medium, blocky structure; extremely firm when moist, extremely hard when dry; pH 6.5; gradual boundary.

B22t—30 to 44 inches +, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) when moist; many, medium, distinct mottles of dark grayish brown (10YR 4/2) when moist; massive (structureless); very firm when moist, very hard when dry; pH 7.0; gradual boundary.

The color of the A1 horizon ranges from very dark grayish brown to grayish brown. The color of the A2 horizon ranges from very pale brown to pale brown, and its thickness ranges from 5 to 15 inches. The depth to the claypan ranges from 16 to 26 inches. Mottles in the B2 horizon range in amount from few to many, and in size from fine to medium.

Alluvial soils

The Alluvial soils are in the azonal order. They are forming in materials that have been transported and recently deposited on flood plains. With each new flood, the soils receive new deposits of soil material or lose part of the old material. As a result, the present material has not been modified or has been only weakly modified by the soil-forming processes.

In Rogers County, soils in the Alluvial great soil group are the Osage and Verdigris.

Osage series.—The Osage series consists of deep, dark-colored, fine-textured, poorly drained soils on flood plains. These soils developed under scattered trees and tall native grasses from recent alluvium that washed from prairies. The Osage soils are subject to occasional floods.

The Osage soils are associated with the Verdigris soils but are finer textured and less permeable.

Profile of Osage clay in a pecan grove 1,200 feet west of southeast corner of sec. 35, T. 22 N., R. 15 E.—

A1—0 to 22 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; strong, medium, subangular blocky structure; very firm when moist, very hard when dry; pH 6.5; gradual boundary.

C—22 to 34 inches +, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; few, fine, faint mottles of dark brown (10YR 4/3); few, small, dark concretions; massive (structureless); pH 6.5.

The A horizon ranges from 10 to 28 inches in thickness, and from dark gray to black in color. The mottles in the lower horizon vary greatly in abundance.

Verdigris series.—The Verdigris series consists of deep, medium textured and moderately fine textured, nearly level soils on flood plains. These soils formed in recent

alluvium washed mainly from prairies. The native vegetation consisted of scattered hardwood trees and tall prairie grasses.

The Verdigris soils are associated with the Osage soils. They are better drained and have browner or lighter colored lower horizons than the Osage soils.

Profile of Verdigris silt loam on 0 to 1 percent slopes in a cultivated field 300 yards east of Verdigris River near east side of sec. 14, T. 22 N., R. 15 E.—

A1—0 to 16 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; roots abundant; pH 6.3; gradual boundary.

AC—16 to 32 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark grayish brown (10YR 3/2) when moist; few, fine, faint mottles of light yellowish brown (10YR 6/4); moderate, medium, granular structure; friable when moist, slightly hard when dry; pH 7.0; gradual boundary.

C—32 to 50 inches +, dark-brown (10YR 4/3) heavy silt loam, very dark brown (10YR 3/3) when moist; weak, fine, granular structure; friable when moist, hard when dry; pH 7.0.

The texture of the surface layer and the lower horizons ranges from silt loam to clay loam. Surface drainage is good to moderately good, and internal drainage is slow to medium.

Lithosols

The Lithosols belong to the azonal order. These soils typically have little or no profile development, consequently, they do not have genetically related horizons. They consist of a freshly and imperfectly weathered mass of rock fragments and generally are on steeply sloping land.

In Rogers County the Collinsville and Sogn soils, which developed under prairie grasses, and the Hector soils, which developed under trees, are in the Lithosol great soil group.

Collinsville series.—The Collinsville series consists of soils that developed on noncalcareous sandstone of the Pennsylvanian geologic age. They are characterized by a thin, acid, stony surface layer that grades downward to disintegrated sandstone.

The Collinsville soils are associated with Bates and Dennis soils, but they are much more shallow and stony.

Profile of Collinsville stony loam in native grass pasture at the center of the north side of sec. 28, T. 20 N., R. 17 E.—

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist; few sandstone fragments; roots abundant; pH 6.0; clear boundary.

C—5 to 10 inches, dark grayish-brown (10YR 4/2) fine material, very dark grayish brown (10YR 3/2) when moist; fragments of sandstone make up about 90 percent; pH 6.0.

R—10 inches +, sandstone bedrock.

Slopes range from 3 to 35 percent and average about 15 percent. The depth to bedrock ranges from 4 to 15 inches. Stones cover from 4 to 18 percent of the surface.

Hector series.—The Hector series comprises shallow to very shallow, moderately coarse textured, somewhat excessively drained soils in the uplands. These are skeletal soils that have little profile development and are stony in most places. They developed under trees from sandstone of Pennsylvanian age.

The Hector soils are associated with Linker soils. They have less distinct horizons and are not so deep as the Linker soils.

Profile of Hector stony sandy loam on 2 percent slopes in woodland pasture 860 feet south of northeast corner of sec. 33, T. 23 N., R. 17 E.—

A1—0 to 5 inches, brown (10YR 5/3) stony sandy loam, dark brown (10YR 4/3) when moist; very weak, granular structure; very friable when moist, soft when dry; few sandstone fragments; pH 5.5; clear boundary.

A2—5 to 12 inches, reddish-yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) when moist; massive (structureless); very friable when moist, soft when dry; many sandstone fragments in lower part; pH 5.5, gradual boundary.

C—12 to 18 inches, weathered, coarse-grained sandstone; pH 5.5.

R—18 inches +, sandstone bedrock.

The color of the A1 horizon ranges from grayish brown to brown, and that of the A2 horizon from light brown to reddish yellow. Outcrops of sandstone range from few to common, and depth to sandstone bedrock ranges from 6 to 20 inches. The slopes range from 3 to 30 percent.

Sogn series.—In the Sogn series are very shallow soils that developed under mixed prairie grasses from limestone of Pennsylvanian geologic age. They are associated with the Newtonia and Summit soils. They differ from those soils mainly in having much thinner solum and in being less developed.

Profile of Sogn soils in native grass pasture in the northeast corner of sec. 16, T. 22 N., R. 15 E.—

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; strong, coarse, granular structure; friable when moist, slightly had when dry; few limestone rocks and fragments; pH 8.0.

R—8 inches +, limestone bedrock.

The slopes range from 1 to 20 percent and average about 5 percent. The A horizon ranges from very dark gray to reddish brown in color and from silt loam to clay loam in texture. Depth to bedrock ranges from 4 to 15 inches. Stones cover from 0 to 20 percent of the surface.

General Nature of the County

Some general facts about Rogers County are given in this section. Water resources and climate, as well as the history of the county, are discussed.

Water Resources

The supply of ground water in Rogers County is not enough to provide water for industry, municipalities, or irrigation. In most areas, however, drilled or dug wells supply enough water for household use. On some soils, such as the Sogn, wells are not dependable, and farmers either haul water for home use or impound it in cisterns or in dug reservoirs.

The rivers, creeks, natural lakes, springs, and constructed ponds and reservoirs provide an abundance of

surface water for livestock and for household use on most farms in the county.

Most farm homes have modern water facilities that utilize water from wells and farm ponds. Where farm ponds or lakes are used, the turbid water may clog the filters. The cost of chemicals used to purify the water is relatively high. Cities that use water from lakes have the same problems.

More than 3,100 ponds, lakes, and reservoirs have been built in the county since 1930. There are 21 lakes that have a surface area of 10 acres or more. The largest of these, the Oologah Reservoir, has 5,950 acres. Others are Claremore Lake, 470 acres; Horseshoe Lake, 200 acres; Fin and Feather Lake, 126 acres; Yonkipic Lake, 40 acres; Chelsea City Lake No. 2, 40 acres. The other 15 lakes have a surface area that ranges from 10 to 40 acres. There are numerous livestock watering ponds that range from 5 to 10 acres in size.

The estimated loss of water by evaporation annually from each lake or pond is from 3 to 6 feet. The amount depends on rainfall, temperature, humidity, wind, and other factors. Ponds that have a considerable surface area and are 6 feet deep or more provide a dependable supply of water during times of drought. Most ponds and reservoirs have been built to meet engineering specifications of the Soil Conservation Service. Their primary purpose is to provide water for livestock on pasture and rangelands. On many farms two or more ponds have been built mainly to provide more watering places in pastures and better distribution of grazing. Most owners of better ponds use them for recreation. This use includes fishing, hunting, swimming, boating, and related sports.

Strip mining of coal in Rogers County has left many pits. The pits are from ⅛ to 1 mile long, 40 to 50 feet wide, and 5 to 15 feet deep, and many contain water. Water in the pits is nearly always clear, and the pits soon become stocked with fish naturally or artificially. These pits also provide swimming and other kinds of recreation (fig. 26). Samples that have been analyzed show that the water from strip mine pits, ponds, and streams is safe for irrigation. Little irrigation, however, has been practiced in this county.

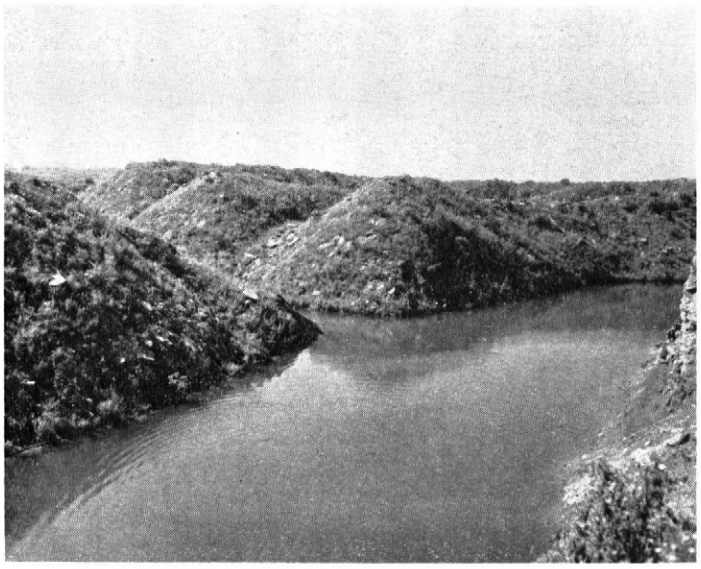

Figure 26.—**Mounds and pits from strip mining provide grazing for livestock, a habitat for wildlife, a water supply, and recreation.**

The Tulsa-Spavinaw waterline crosses Rogers County, and landowners along the line are permitted to use water from it.

The Verdigris River rises in the southern part of Kansas and crosses Rogers County from northeast to southwest near the central part. Its major tributaries are the Caney River, Bird Creek, and Dog Creek. The Caney River rises in the southern part of Kansas and enters the county from the west. It flows into the Verdigris River about 4 miles west of Claremore. Bird Creek rises in the central part of Osage County, enters Rogers County near the southwestern corner, and flows into the Verdigris River at Catoosa. Dog Creek rises near Chelsea and flows into the Verdigris River about 8 miles south of Claremore. Pryor Creek crosses the northeastern corner of the county near Chelsea.

Climate [10]

Rogers County is in the prairie plains of northeastern Oklahoma and has a temperate, continental climate of the moist, subhumid type that borders on the humid type to the east. This transitional area receives the warmer, moisture-laden air from the Gulf of Mexico, which is regularly penetrated by the cooler, drier air moving down from the north. Rapid penetration of cool air sometimes results in significant variations of temperature, precipitation, cloudiness, and wind velocity.

The definite seasonal characteristics of climate usually vary in intensity from year to year, but changes between seasons are gradual. Winters are mostly moderate and sunny. The cold periods usually last only a few days before they are moderated by a southerly wind. The heaviest seasonal rain, in the spring and fall, benefits growing crops and pastures. Also, spring rains are accompanied by the greatest incidence of severe local storms and tornadoes. Summers are usually hot, but the long warm periods are generally relieved by cool nights, pleasant breezes, and occasional heavy local showers. The autumn season has longer periods of mild, sunny days interspersed with slower, soaking rains that are beneficial to fall-seeded grain and to pasture. Temperature and precipitation data for the county are shown in table 9.

Rogers County has a mean annual temperature of 60.4° F. and a range in temperature from 37.9° in January to 81.9° in July. The mean daily variation of 23.7° provides a stimulating climate. Temperature extremes have ranged from 116° (August 10, 1936) to 21° (January 22, 1930). Temperatures of 90° or higher occur on an average of 77 days a year from March through October, and 100° or higher occur on 15 days from March through September. The hottest summer was in 1936 when 70 days had a temperature of 100° or higher. In August 1936 there were 22 consecutive days of 100° and a total of 26 such days. Freezing temperatures occur on an average of 82 days a year. Temperatures of 0° or below are common and have occurred on as many as 25 days in 14 different years

[10] This section was prepared by STANLEY G. HOLBROOK, Oklahoma State climatologist, U.S. Weather Bureau.

TABLE 9.—*Temperature and precipitation at Claremore, Rogers County, Okla.*

[Data from 1931 to 1960]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with—		Average total	1 year in 10 will have—		Days with snow cover 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	48.6	27.1	67	10	1.85	0.3	4.2	4	2
February	53.5	30.4	71	15	1.87	.6	3.5	3	2
March	61.8	37.3	79	21	2.54	.7	5.5	2	2
April	72.2	48.4	85	32	3.95	1.4	8.2	0	----------
May	78.6	57.2	89	45	5.52	1.8	10.7	0	----------
June	88.4	66.2	98	57	4.91	1.5	11.1	0	----------
July	93.8	69.9	104	62	3.16	.1	6.2	0	----------
August	94.2	69.0	105	59	3.03	.4	6.0	0	----------
September	87.1	60.5	99	47	3.89	.3	9.7	0	----------
October	76.4	49.7	88	35	3.36	.3	8.1	0	----------
November	60.8	36.7	78	21	2.21	.2	5.9	1	1
December	51.5	30.0	70	16	1.79	.4	3.1	3	2
Year	72.2	48.5	[1] 104	[2] 2	38.08	26.6	48.4	13	2

[1] Average annual highest maximum. [2] Average annual lowest minimum.

in the period 1931–60. On the average, there are about 7 days a year when the temperature fails to rise above freezing.

The average freeze-free season for Rogers County ranges from 202 days in the northeastern part to 215 days in the southern part. This season is generally long enough for crops to mature. Freezes have been as late as April 22 (1927 and 1931) and as early as October 1 (1958). The probability of the first and last freeze is shown in table 10.

The average annual precipitation in Rogers County is 38.08 inches, according to records at Claremore, Okla., for the period 1931–60. The annual precipitation since 1916 has ranged from a low of 24.21 inches in 1952 to a high of 62.48 inches in 1941. Spring is the wettest season. About 32 percent of the annual precipitation is in spring; 29 percent, in summer; 25 percent, in fall; and 14 percent, in winter. Average monthly precipitation is 1.79 inches in December, but slightly more than three times that amount in May. The next largest monthly average occurs in September. The highest precipitation recorded was 18.62 inches in May 1943. Since 1915, only 4 months have failed to have measurable precipitation.

Although precipitation in summer is the most important, it is often irregular. Extended dry periods in summer can affect crop maturity. Wet periods are usually beneficial. The greatest loss of precipitation occurs when heavy showers fall on nonterraced, sloping fields. Heavy 24-hour precipitation of 3 to 7 inches has occurred during all months except February and November. The greatest daily amount (7.00 inches) occurred during the 24-hour period ending at 6:00 p.m. on January 20, 1904.

A part of the precipitation in winter is provided by an average seasonal snowfall of about 7 inches, which occurs from November through April. A measurable amount of snow has fallen in 45 of 48 winters since 1915–16. In 12 winters, the snowfall was 11 inches or more, and in 3 it was 18 inches or more. In the winter of 1923–24 it was 29.1 inches. January is the most likely month for snow, but the greatest monthly snowfall was 17.6 inches in March 1924. The greatest daily snowfall of 8 inches occurred on January 9, 1930.

The prevailing wind is southerly to southeasterly except during midwinter, when it is predominantly northerly. Wind velocity averages 8 miles per hour in July and August. The greatest velocity is in winter and the early part of spring; the highest monthly average velocity (13 miles per hour) is in March.

Extreme wind velocities of 75 to 80 miles per hour can be expected occasionally in the county during severe storms. The most dreaded storms are tornadoes; 20 have occurred in the county since 1875. Most of them struck rural areas and damaged farmsteads.

Ten damaging hailstorms have occurred in the county since 1924. Only storms that had hailstones three-fourths inch in diameter or larger were recorded. The ratio of 1.4 hailstorms per 100 square miles in Rogers County is relatively low, as compared with the maximum of 4.3 for the western part of the State. The greatest frequency of hailstorms is in April and May. The maximum size of hailstones recorded is 2⅝ inches in diameter, and the greatest accumulation was a depth of 2 inches near Talala on May 9, 1959.

Because of the low rate of evaporation in the northeastern part of the State, the average annual lake evaporation for Rogers County is 49 inches. Of this amount, 72 percent occurs from May to October. This low evaporation rate is accompanied by the lowest average monthly wind velocity during the hot summer months, which helps to limit the loss of soil moisture.

The weather in Rogers County is normally favorable to the sequence of agricultural operations. Nevertheless, climate does affect (1) the amount of water erosion, (2)

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Claremore, Oklahoma]

Probability	Dates for given probability and temperature				
	16° F.	20° F.	24° F.	28° F.	32° F.
Spring:					
1 year in 10 later than	March 11	March 20	April 2	April 11	April 17.
2 years in 10 later than	March 3	March 14	March 26	April 6	April 12.
5 years in 10 later than	February 15	March 1	March 12	March 28	April 3.
Fall:					
1 year in 10 earlier than	November 26	November 15	October 29	October 20	October 15.
2 years in 10 earlier than	December 3	November 22	November 5	October 25	October 20.
5 years in 10 earlier than	December 16	December 5	November 18	November 3	October 29.

the leaching of soil minerals and nutrients, (3) the rate of decay of organic matter, (4) weed competition, and (5) activities of insects. All may be substantially reduced, however, by good soil and water management and the use of other recommended practices.

History [11]

Before 1800, Rogers County was a part of a large primeval region that consisted mainly of grasslands but had some timber in the rougher uplands and in the bottoms. At that time, Indian agents reported that this region was so rich in wild game that the supply could never be exhausted. It was used as a hunting ground by many tribes of Indians.

In 1796 Choteau, a French trader, established a trading post on Grand (Neosho) River at the present site of Saline, Okla. He sought to control the rich supply of pelts by persuading the Osage Indians to settle here. One clan under Chief Claremore settled near Claremore mound, 5 miles northwest of the present site of Claremore. Another clan under Chief Black Dog settled on Dog Creek near Claremore.

The Osage Indians relied largely on wild fruits, nuts, and game animals and fowls for food and clothing. Their agriculture consisted mainly of raising semi-wild hogs and growing patches of corn and squash and a few peach orchards. The Indians left the land largely in a virgin condition until about 1830 to 1840.

After the Louisiana Purchase in 1803, the U.S. Government began to plan the removal of the five civilized tribes of Indians from the southeastern States to the Indian Territory. The Cherokee Indians were assigned the part of the Territory containing Rogers County, which was called the Cherokee Nation. A few Cherokees, known as old settlers, emigrated to this area between 1809 and 1837.

Between 1837 and 1840, many of the Cherokees were brought to Indian Territory by force over what was called the Trail of Tears. They described the area as a lonely, treeless prairie. Most of them settled in the wooded sections of eastern Oklahoma, as that area was more like their homeland.

[11] By MYRON A. HURD, work unit conservationist, Soil Conservation Service.

The Cherokee Indians were more advanced in agriculture than the Osage Indians. They raised corn, squash, vegetables, fruits, hogs, cattle, and horses. Each Cherokee citizen could claim and fence 40 acres of land. Otherwise, the Nation was open range. The first trading post was established on Dog Creek near the present site of Claremore in 1842 by Elijah Hicks, a Cherokee. One Cherokee School, Mount Claremore, had 38 Indian pupils in 1859. The Cherokee Nation was subdivided into districts, and Rogers County became part of the Cooweescoowee District.

The Cherokee Nation was made desolate during the Civil War of 1861–65. The Indians were divided in their sympathy and were caught in the crossfire of the Union and Confederacy. The few Indians who had settled in this area emigrated to Kansas or to Texas for the duration of the war.

In 1867 some Cherokees returned and reorganized the seat of government of the Cooweescoowee District at Kephart Springs, 4 miles northeast of the present site of Claremore. They established West Point school near Claremore. Many trading posts were opened in the area.

By 1868 cattle from Texas were being driven through this area to eastern markets. When Texas cattlemen saw the rich rangeland in the territory, they conspired with Cherokee citizens to stock the vast ranges. They sold cattle on contract to the leading citizens who held grazing rights, and each shared the profits when the grass-fattened cattle were moved on to market. This early interest in rangeland encouraged the blocking up of large acreages into ranges. One of these ranges 4 miles northeast of Oologah was owned and operated by Clem Rogers, for whom the county was named. He was the father of Will Rogers, renowned humorist, cowboy, and ambassador of good will.

The towns of Claremore, Catoosa, Chelsea, and Foyil were founded after the completion of the St. Louis-San Francisco Railroad through Rogers County in 1882. Talala, Oologah, and Inola were founded after the Missouri-Pacific Railroad was completed in 1889. Thereafter this area developed rapidly.

The opening of the Cherokee Strip in 1893 brought an influx of white settlers to the Cherokee Nation. The newcomers were eager to lease the fertile land for crops, and the prairie sod was plowed up. Annual burning of the

rank topgrowth of grass became a common practice. The early settlers described the prairie fires during summer or early fall as a great wave of flame and greasy black smoke rushing across the prairie faster than a horse could run. These fires consumed everything combustible in their path for a distance of 15 to 20 miles.

When the allotment act was passed, tracts of land from 10 to 160 acres in size were allocated to Cherokee Indians and to Negro freedmen. Section lines were laid out about the year 1900. Fences began to appear, and plowing, or sodbusting, began in earnest. The operators of smaller tracts overstocked their pastures and plowed areas not suitable for cultivation without protection. The era of the grain binder and threshing machine, when strawstacks and cornfields were either grazed or burned during the winter, depleted the soils of organic matter and minerals. Sheet erosion started after plowing, and soon gullies formed. Within a period of 10 to 15 years, severe erosion had damaged many fields. No attention was given to the protection of the soil and very little to the maintenance of fertility.

When Oklahoma was admitted to the Union in 1907, some lands were allocated to fullblooded Indians and were placed on a restricted list. The Indians became wards of the U.S. Indian Service.

The unrestricted allotments of land to part Cherokees and to freedmen could be sold by the owners. Many of the ranchers and large landowners acquired title to many allotments by buying the owner out cheap, in some instances, after scaring him off his land.

The State of Oklahoma withheld some lands for schools. There are still a few tracts of school land and restricted Indian land in the county. Most of the land, however, has changed ownership several times since statehood.

After the start of the first World War in 1914, the demand for more wheat increased. A second period of plowing up sod occurred, principally in the more level pastures that were infested with weeds. After the introduction of tractors, one-man farm units were started. These farm units were consolidated, however, when farmers began to realize that they could not make a living on 80 acres.

The depression of 1920–21 impoverished most cattlemen and wheat farmers. Many sold out and left the county, and mortgagees and lease operators took over many farms. Then in the latter part of this decade (1928–29), many farmers mortgaged their home place to buy adjoining land, for a larger operating unit seemed a necessity.

Agriculture was in an unstable condition in Rogers County when the second World War started. About this time, the Rogers County Soil Conservation District was organized. The job of giving direction and purpose to the agricultural program required great effort by all agricultural workers. The district members concentrated on getting conservation practices started, planning a long-term conservation program to fit the needs of the land, and good land use. District funds were used to purchase grass spriggers, fertilizer spreaders, cultipacker planters, sod drills, graders, land levelers, and other special equipment for use in soil conservation work.

The trend in farming for the last 20 years has been toward the growing of grasses and other close-growing crops, along with the production of livestock. Much progress has been made in establishing, improving, and managing tame and native pastures.

Much progress has also been made in applying conservation practices on croplands. Improved farming methods have been adopted. Operators are taking the less productive fields out of clean-tilled crops and establishing grasses and legumes for tame pasture. Higher yields of crops are now produced on croplands by using more fertilizer, better varieties of crops, better equipment, better soil management, and protection practices.

The demand for farms has continued to increase since the Second World War; the trend is toward larger units. Farming has become highly mechanized. On the larger farms 10,000 to 20,000 dollars are invested in farm machinery.

Because of the demand for labor in defense and other industrial plants and high wages, about 75 percent of the farm operators in the county are employed off their farms. The family operates the farm or rents it to a neighbor. Most of the farm homes are modern and in good repair. People in industry and in other occupations commonly purchase a farm as a country home. The price of farms has increased greatly since 1940.

Agriculture

The present trend in agriculture is toward the production of more livestock and less grain. According to the census of agriculture, the gross farm income for the county in 1959 was more than $5,000,000. Most of the income was from the sale of livestock and livestock products, which has increased greatly since 1939.

The average acre value of farmlands increased greatly from 1939 to 1959, as did the average farm investment. The average size of farms has been increasing steadily since 1950.

Cattle ranching is the most important enterprise in Rogers County. According to the Oklahoma Crop and Livestock Reporting Service, the number of cattle rose from 33,600 in 1940 to 53,000 in 1961.

Herds of both purebred and grade beef cattle are maintained in the county. The dominant breeds are the Angus and Hereford, and most farmers keep registered bulls. Many farmers buy a few registered cows to help build up their herds, but many herds contain only registered animals.

Supplemental feed generally is needed in winter, particularly in very cold weather or after snowstorms. Hay, oats, or grain sorghum is used as a filler and as supplementary winter feed. In 1959 the total acreage used for hay was 26,799; for oats, 13,395; and for sorghum, 6,010. A total of 1,149 acres of the sorghum was hogged, grazed, or cut for dry forage. Cottonseed cake and soybean cake or meal are used as supplementary protein feed.

Dairying is an important farm enterprise. Dairy farming is generally a family operation. The number of dairy cows dropped from more than 10,000 in 1959 to about 6,000 in 1961.

The numbers of hogs, sheep, and poultry have decreased since 1940. Many people are interested in riding horses, and high prices are paid for good ones. Several farmers are now raising saddle horses, race horses, and ponies. The demand for horses for recreational use is increasing.

Industries

The production of oil and gas has been extensive in the northern part of the county. Strip mining coal has also been extensive; about 5,900 acres have already been stripped. The vein of coal crops out along a narrow strip across the county parallel to U.S. Highway No. 66.

High-grade limestone is extensive in the western and central parts of the county. Limestone is quarried for cement production west of Catoosa. It is being crushed for roads and other building materials in many parts of the county. Beds of cherty limestone gravel along the Verdigris River are mined for road and fill materials.

Grain elevators are operated at Claremore, Oologah, Talala, Inola, and Catoosa. At most of these places, feed is ground and processed for local use.

There is a nursery at Inola and a greenhouse at Claremore and at Catoosa.

A steam-generated electric power plant is operated at Oologah. At Claremore a steel-casting plant, a luggage plant, and a chemical plant are in operation.

When proposed navigation is completed on the Verdigris River to Port of Catoosa, industry is expected to be greatly expanded in Rogers County. A space and missile corportion has purchased a site for a port facility along the Verdigris River east of Catoosa. The proposed port facility is north of Catoosa on Bird Creek in Rogers County.

Transportation and Markets

Rogers County is served by two major railroads. The St. Louis-San Francisco Railroad serves Catoosa, Claremore, and Chelsea. The Missouri-Pacific Railroad serves Inola, Claremore, Oologah, and Talala.

State Highway Nos. 20, 28, 28A, 33, and 88 and U.S. Highway Nos. 44, 66, and 169 provide the county with routes to all towns. Several trucklines and motor express lines serve the principal towns and make daily connection with Tulsa, Muskogee, Bartlesville, and Oklahoma City.

Most of the grain and poultry products are hauled by farmers and sold at local markets. Commercial haulers transport a large part of the hay to other areas. Most livestock are hauled to the stockyards at Tulsa. Some livestock are sold at the farm as feeders, mainly to out-of-State buyers. Most dairies in the county produce grade A milk, which is picked up at the farm and transported to processing plants in Tulsa.

Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of total exchangeable bases), or both, that the growth of most crop plants is reduced.

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Base course (engineering). In road construction, selected material of planned thickness used as foundation for pavement.

Blanket (engineering). A thin layer of clayey soil or other slowly permeable material placed on the upstream floor of an embankment to retard the seepage of water.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Complex soil. A mapping unit consisting of two or more kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; soil will not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed into a lump.

Firm.—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil is readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, soil adheres to other material; tends to stretch and pull apart, rather than pull free from other material.

Hard.—When dry, soil is moderately resistant to pressure, can be broken with difficulty between thumb and forefinger.

Soft.—When dry, soil breaks into powder or individual grains under slight pressure.

Cemented.—Soil is hard and brittle; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Crusty soil. Soil tending to form a thin, massive or platy surface layer under the beating action of raindrops. The opposite of "crusty" is "self-mulching."

Diversion. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage, natural. Refers to the conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time, and in podzolic soils commonly have mottlings below 6 to 16 inches in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, though mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western ranges.

Gilgai. The microrelief of those clays that have a high coefficient of expansion and contraction with changes in moisture content; usually a succession of microbasins and microknolls in

nearly level areas, or of microvalleys and microridges that run with the slope.

Grazing capacity. The maximum number of animals or animal units per acre, or acres per animal unit, that a grazing area can support adequately without deterioration; sometimes called carrying capacity.

Habitat. The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives, as opposed to its range, or geographical distribution.

Heavy soil. An old term formerly used for clayey or fine-textured soils.

Herb. A plant that dies annually or after flowering; grasses and forbs, as distinguished from shrubs and trees.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, with characteristics produced by soil-forming processes.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none*, *very slow*, *slow*, *medium*, *rapid*, and *very rapid*.

Liquid limit (soil engineering). The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system of designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Permeability, soil. The quality of the soil horizon that enables water or air to move through it. Terms used to describe permeability and their equivalent ratio in inches per hour are as follows: *Very slow* (less than 0.05), *slow* (0.05 to 0.20), *moderately slow* (0.20 to 0.80), *moderate* (0.80 to 2.50), *moderately rapid* (2.50 to 5.00), *rapid* (5.00 to 10.00), and *very rapid* (over 10.00).

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Plastic (soil consistence). Capable of being deformed without being broken.

Plastic limit (soil engineering). The moisture content at which a soil changes from a semisolid to a plastic state.

Plasticity index (soil engineering). The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. In words, the degrees of acidity and alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.5 to 7.3		

Relief. The elevations or inequalities of the land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the base of a slip surface on a relatively steep slope; and in swelling clays, where there is marked change in moisture content.

Slick spots. Small areas in a field that are slick when wet because they contain excess exchangeable sodium, or alkali.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subgrade (engineering). The substratum, consisting of in-place material or fill material, that is prepared for highway construction; does not include stabilized base course or actual paving material.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportion of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. Presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND RANGE SITES

[See table 1, p. 5, for approximate acreage and proportionate extent of the soils, and table 2, p. 27, for productivity ratings of each unit. See pp. 39 to 50 for information on engineering properties of the soils]

Map symbol	Mapping unit	Page	Capability unit		Range site	
			Symbol	Page	Name	Page
Bc	Bates-Collinsville complex	4	IVe–1	23	Loamy Prairie	30
BdC2	Bates and Dennis soils, 3 to 5 percent slopes, eroded.	5	IIIe–4	22	Loamy Prairie	30
Bp	Borrow pits	5	VIIIs–1	26	Not assigned	
Br	Breaks-Alluvial land complex	5				
	Breaks part		VIe–1	24	Loamy Prairie	30
	Alluvial land part		VIe–1	24	Loamy Bottomland	34
ChB	Choteau silt loam, 1 to 3 percent slopes	6	IIe–2	19	Loamy Prairie	30
CmB	Claremore silt loam, 0 to 3 percent slopes	6	IIIe–5	22	Loamy Prairie	30
Co	Collinsville stony loam	6	VIIs–2	24	Shallow Prairie	31
DbC	Dennis-Bates complex, 2 to 5 percent slopes	7	IIIe–1	20	Loamy Prairie	30
DnB	Dennis silt loam, 1 to 3 percent slopes	7	IIe–2	19	Loamy Prairie	30
DnC	Dennis silt loam, 3 to 5 percent slopes	7	IIIe–1	20	Loamy Prairie	30
DwA	Dwight silt loam, 0 to 1 percent slopes	8	IVs–1	24	Shallow Claypan	30
Er	Eroded loamy land	8	VIe–1	24	Loamy Prairie	30
Gp	Gravel pits	8	VIIIs–1	26	Not assigned	
Hc	Hector stony sandy loam	8	VIIs–1	24	Shallow Savannah	33
HlC	Hector-Linker fine sandy loams, 1 to 5 percent slopes.	8				
	Hector part		IVe–2	23	Shallow Savannah	33
	Linker part		IVe–2	23	Sandy Savannah	31
LkB	Linker fine sandy loam, 1 to 3 percent slopes	9	IIe–3	19	Sandy Savannah	31
LkC	Linker fine sandy loam, 3 to 5 percent slopes	9	IIIe–3	21	Sandy Savannah	31
NaA	Newtonia silt loam, 0 to 1 percent slopes	10	I–1	18	Loamy Prairie	30
NaB	Newtonia silt loam, 1 to 3 percent slopes	10	IIe–2	19	Loamy Prairie	30
OkA	Okemah silty clay loam, 0 to 1 percent slopes	10	I–1	18	Loamy Prairie	30
OkB	Okemah silty clay loam, 1 to 3 percent slopes	10	IIe–1	18	Loamy Prairie	30
OkB2	Okemah silty clay loam, 1 to 3 percent slopes, eroded.	10	IIIe–4	22	Loamy Prairie	30
Os	Osage clay	11	IIIw–1	22	Heavy Bottomland	33
PaA	Parsons silt loam, 0 to 1 percent slopes	11	IIs–1	19	Claypan Prairie	30
RmB	Riverton loam, 1 to 3 percent slopes	11	IIe–2	19	Loamy Prairie	30
Rs	Rough stony land	12	VIIs–4	25	Savannah Breaks	32
RvC	Riverton gravelly loam, 3 to 5 percent slopes	11	IIIe–1	20	Loamy Prairie	30
RvC2	Riverton gravelly loam, 3 to 5 percent slopes, eroded.	12	IIIe–4	22	Loamy Prairie	30
Sm	Strip mines	12	VIIe–1	24	Coal Strip Mines	30
So	Sogn soils	12	VIIs–3	25	Very Shallow	31
SuB	Summit silty clay loam, 1 to 3 percent slopes	12	IIe–1	18	Loamy Prairie	30
SuC	Summit silty clay loam, 3 to 5 percent slopes	13	IIIe–2	20	Loamy Prairie	30
SuC2	Summit silty clay loam, 1 to 5 percent slopes, eroded.	13	IIIe–4	22	Loamy Prairie	30
TaA	Taloka silt loam, 0 to 1 percent slopes	13	IIs–1	19	Loamy Prairie	30
Vd	Verdigris silt loam	13	IIw–1	20	Loamy Bottomland	34
Ve	Verdigris clay loam	13	IIw–1	20	Loamy Bottomland	34
Vf	Verdigris soils, frequently flooded	14	Vw–1	24	Loamy Bottomland	34
WsA	Woodson and Summit soils, 0 to 1 percent slopes	14	IIs–2	19	Claypan Prairie	30

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program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
ROGERS COUNTY, OKLAHOMA

N

Scale 1:190080
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 — Dennis-Choteau association: Nearly level and moderately sloping soils formed under prairie grasses, on the uplands

2 — Collinsville-Bates association: Gently sloping to steep, loamy soils formed under prairie grasses, on sandstone uplands

3 — Newtonia-Sogn-Summit association: Gently sloping to strongly sloping, loamy soils formed under prairie grasses, on limestone uplands

4 — Verdigris-Osage association: Nearly level, deep, loamy and clayey soils on bottom lands

5 — Hector-Linker association: Gently sloping to very steep, well-drained, loamy soils formed under trees, on uplands

May 1965

INDEX TO MAP SHEETS

ROGERS COUNTY, OKLAHOMA

N

Scale 1:190080

1 0 1 2 3 4 Miles

Inset, sheet 57

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, if used, shows the slope. Some symbols that do not contain a slope letter are for nearly level soils, such as Osage clay, but others, such as Sogn soils have a considerable range in slope. A final number, 2, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Bc	Bates–Collinsville complex
BdC2	Bates and Dennis soils, 3 to 5 percent slopes, eroded
Bp	Borrow pits
Br	Breaks–Alluvial land complex
ChB	Choteau silt loam, 1 to 3 percent slopes
CmB	Claremore silt loam, 0 to 3 percent slopes
Co	Collinsville stony loam
DbC	Dennis–Bates complex, 2 to 5 percent slopes
DnB	Dennis silt loam, 1 to 3 percent slopes
DnC	Dennis silt loam, 3 to 5 percent slopes
DwA	Dwight silt loam, 0 to 1 percent slopes
Er	Eroded loamy land
Gp	Gravel pits
Hc	Hector stony sandy loam
HlC	Hector–Linker fine sandy loams, 1 to 5 percent slopes
LkB	Linker fine sandy loam, 1 to 3 percent slopes
LkC	Linker fine sandy loam, 3 to 5 percent slopes
NaA	Newtonia silt loam, 0 to 1 percent slopes
NaB	Newtonia silt loam, 1 to 3 percent slopes
OkA	Okemah silty clay loam, 0 to 1 percent slopes
OkB	Okemah silty clay loam, 1 to 3 percent slopes
OkB2	Okemah silty clay loam, 1 to 3 percent slopes, eroded
Os	Osage clay
PaA	Parsons silt loam, 0 to 1 percent slopes
RmB	Riverton loam, 1 to 3 percent slopes
Rs	Rough stony land
RvC	Riverton gravelly loam, 3 to 5 percent slopes
RvC2	Riverton gravelly loam, 3 to 5 percent slopes, eroded
Sm	Strip mines
So	Sogn soils
SuB	Summit silty clay loam, 1 to 3 percent slopes
SuC	Summit silty clay loam, 3 to 5 percent slopes
SuC2	Summit silty clay loam, 1 to 5 percent slopes, eroded
TaA	Taloka silt loam, 0 to 1 percent slopes
Vd	Verdigris silt loam
Ve	Verdigris clay loam
Vf	Verdigris soils, frequently flooded
WsA	Woodson and Summit soils, 0 to 1 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Oil wells

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches (CANAL / DITCH)

Lakes and ponds
- Perennial
- Intermittent

Wells (flowing)

Springs

Marsh

Wet spot

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies

Soil map constructed 1964 by Cartographic Division, Soil Conservation Service, USDA, from 1958 aerial photographs. Controlled mosaic based on Oklahoma plane coordinate system, north zone, Lambert conformal conic projection. 1927 North American datum.

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 1

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

NOWATA COUNTY

WASHINGTON COUNTY

T. 24 N.

R. 14 E. | R. 15 E.

1

N

Timberlake Creek

(Joins sheet 2)

(Joins sheet 8)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(2)

NOWATA COUNTY

R. 15 E.

N

T. 24 N.

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 9)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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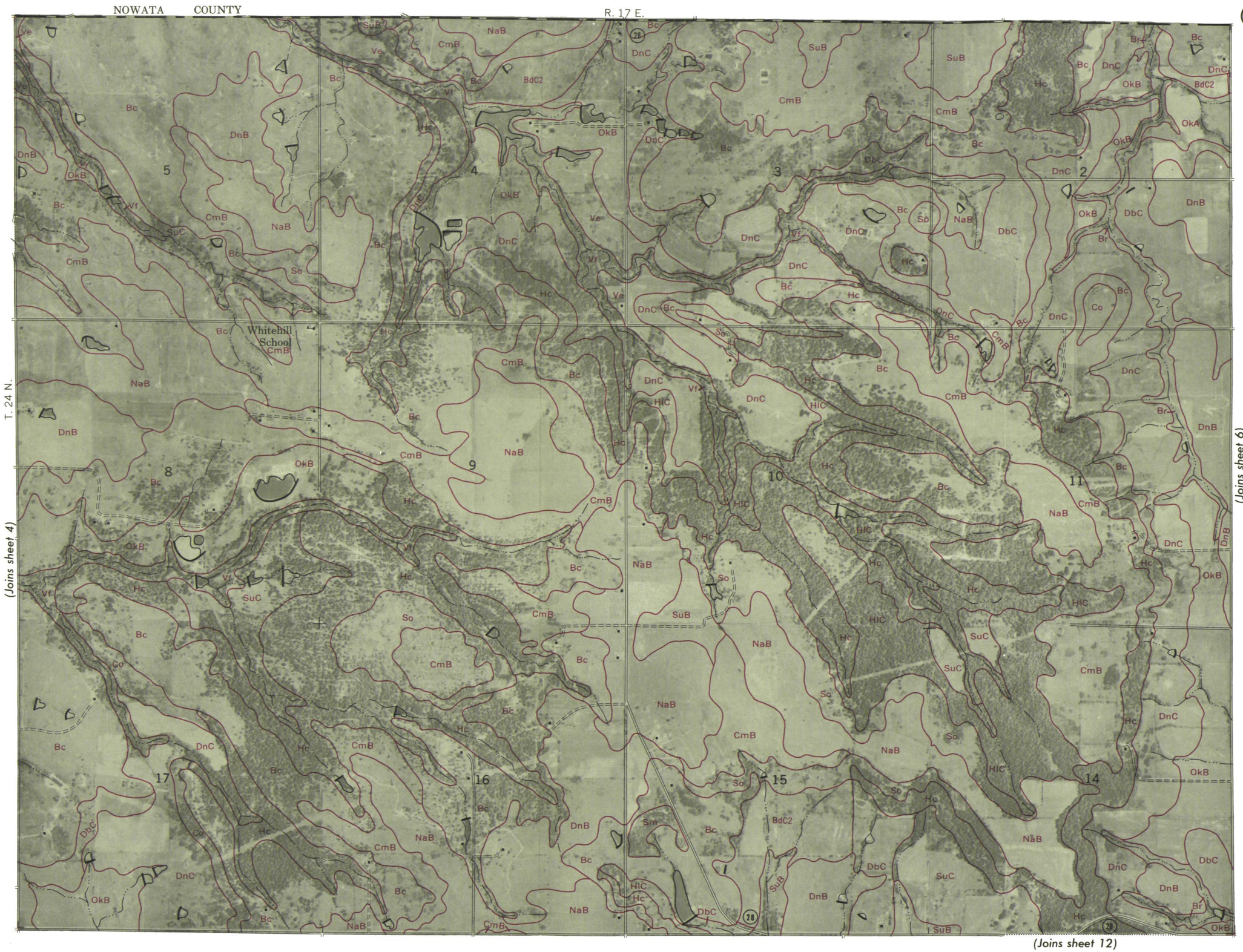
Range, township, and section corners shown on this map are indefinite.

NOWATA COUNTY
R. 16 E.
R. 17 E.
T. 24 N.
N
4
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
VERDIGRIS RIVER
LIGHTNING CREEK
Vd
Ve
Os
CmB
So
Rs
SuC
RmB
ChB
PaA
OkB
Bc
DnB
Vf
NaB
RvC
TaA
WsA
Br
Bp
SuB
DnC
DbC
Plumb Creek
Campbell Creek
Winganon Creek
OOLOGAH RESERVOIR
RmB WINGANON CROSSING
Winganon Church
1
2
3
6
7
10
11
12
13
14
15
18
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 5



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 6

NOWATA COUNTY

CRAIG COUNTY

6

N

(Joins sheet 5)

(Joins sheet 7)

T. 24 N.

(Joins sheet 13)

R. 17 E. | R. 18 E.

Oak Grove School

SAN FRANCISCO

ST. LOUIS

Taylor Creek

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

N

CRAIG COUNTY

R. 18 E.

T. 24 N.

(Joins sheet 6)

(Joins sheet 14)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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Range, township, and section corners shown on this map are indefinite.

8

(Joins sheet 1)

R. 14 E. | R. 15 E.

N

WASHINGTON COUNTY

T. 24 N.

(Joins sheet 9)

(Joins sheet 15)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

10
(Joins sheet 3)
R. 15 E.
R. 16 E.
N
Talala Creek
OOLOGAH RESERVOIR
24
19
20
21
25
30
29
28
36
31
32
33
T. 24 N.
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
CmB
NaB
HlC
Re
Vf
Vd
So
DbC
Rs
Ve
DnB
Os
OkA
SuB
WsA
ChB
RmB
TaA
Br
Bc
SuC
Er
BdC2
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

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Range, township, and section corners shown on this map are indefinite.

R. 16 E. | R. 17 E.

(Joins sheet 4)

11

N

T. 24 N.

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 18)

Winganon

WINGANON CEMETERY

OOLOGAH RESERVOIR

Dog Creek

Spencer Creek

22 23 24 19

27 26 25 30

34 35 36 31

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 5)

R. 17 E.

T. 24 N.

N

Chelsea Reservoir

Wallar School

Spencer Creek

20 21 22 23 29 28 27 26 32 33 34 35

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 18)

(Joins sheet 19)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

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R. 17 E. | R. 18 E.

T. 24 N.

(Joins sheet 6)

(Joins sheet 12)

(Joins sheet 19)

(Joins sheet 14)

13

N

Chelsea

SAN FRANCISCO ST LOUIS

Pryor Creek

24 19 20 21 25 30 29 28 36 31 32 33

MAYES COUNTY

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

14
(Joins sheet 7)
R. 18 E.
N
T. 24 N.
(Joins sheet 13)
22
23
24
27
26
25
34
35
36
Curdy School
Creek
Prior
Little
CRAIG COUNTY
MAYES COUNTY
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

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R. 14 E. | R. 15 E.

(Joins sheet 8)

15

N

T. 23 N.

WASHINGTON COUNTY

(Joins sheet 16)

(Joins sheet 20)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

16
N
(Joins sheet 9)
R. 15 E.
T. 23 N.
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 21)
PACIFIC
MISSOURI
Fourmile
Scale 1: 20 000
0
½
1 Mile
0
5000 Feet

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 17

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

N

R. 16 E. | R. 17 E.

(Joins sheet 11) | (Joins sheet 12)

OOLOGAH RESERVOIR

T. 23 N.

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 23)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

R. 17 E.

(Joins sheet 12) | (Joins sheet 13)

19

N

T. 23 N.

(Joins sheet 18)

MAYES COUNTY

(Joins sheet 24)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 15)

R. 14 E. | R. 15 E.

T. 23 N.

N

Zion Hill Church

Creek

CANEY RIVER

WASHINGTON COUNTY

TULSA COUNTY

(Joins sheet 21)

(Joins sheet 25)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 21

R. 15 E.

(Joins sheet 16)

21

N

T. 23 N.

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 26)

Oologah

OOLOGAH DAM

OOLOGAH RESERVOIR

Fourmile Creek

MISSOURI PACIFIC

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

22

N

(Joins sheet 17)

R. 15 E. | R. 16 E.

T. 23 N.

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 27)

RESERVOIR

OOLOGAH

Blue Creek

19 20 21 24 28 29 30 31 32 33 36

NaB So SuC Br OkB Rs CmB ChB DbC WsA SuB Bc Ve Vf Bp SuC2

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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Range, township, and section corners shown on this map are indefinite.

R. 16 E. | R. 17 E.

(Joins sheet 18)

23

N

T. 23 N.

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 28)

WARD GROVE CEMETERY

Foyil

SAN FRANCISCO

ST LOUIS

66

Scale 1: 20 000

0 ½ 1 Mile

0 5000 Feet

(Joins sheet 19)
R. 17 E.
N
Bushyhead
SAN FRANCISCO
ST. LOUIS
Dog Creek
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
28A
66
(Joins sheet 23)
(Joins sheet 29)
T. 23 N.
MAYES COUNTY
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

26
(Joins sheet 21)
R. 15 E.
N
OOLOGAH DAM
OOLOGAH RESERVOIR
OLD HWY 88
Bluejacket Creek
MISSOURI PACIFIC
VERDIGRIS RIVER
T. 22 N.
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 31)
DbC
BdC2
DnB
TaA
WsA
OkA
NaB
SuB
SuC
CmB
So
Vf
Ve
Vd
Rs
Os
Br
Bc
Co
1
2
3
4
5
8
9
10
11
14
15
16
17
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

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Range, township, and section corners shown on this map are indefinite.

R. 15 E. | R. 16 E.

T. 22 N.

(Joins sheet 22)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 32)

27

N

VERDIGRIS RIVER

Sweetwater Creek

MISSOURI PACIFIC OLD HWY 66

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(28)

(Joins sheet 23)

R. 16 E. | R. 17 E.

N

T. 22 N.

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 33)

Sequoyah

SAN FRANCISCO

ST LOUIS

Sweetwater Creek

Little Dog Creek

Dog Creek

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

R. 17 E.

T. 22 N.

(Joins sheet 24)

(Joins sheet 28)

(Joins sheet 34)

N

MAYES COUNTY

Little Dog Creek

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 25)

30

R. 14 E. | R. 15 E.

N

Collinsville Reservoir

CANEY R

CANEY RIVER

22 23 24 19

27 26 25 30

34 35 36 31

TULSA COUNTY

T. 22 N.

(Joins sheet 31)

(Joins sheet 35)

Ve Vf Vd Hc Os Co Br DnC DbC DnB Bc BdC2 NaB SuB CmB So Rs

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

R. 15 E.

(Joins sheet 26)

31

N

T. 22 N.

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 36)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(Joins sheet 27)

R. 15 E. | R. 16 E.

T. 22 N.

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 37)

N

Sageeyah

New Hope Church

OLD HWY 88

MISSOURI PACIFIC

ST LOUIS SAN FRANCISCO

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

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Range, township, and section corners shown on this map are indefinite.

R. 16 E. | R. 17 E.

(Joins sheet 28)

33

N

T. 22 N.

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 38)

Sequoyah School

SAN FRANCISCO ST LOUIS

Dog Creek

LAKE CLAREMORE

Degroat

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

34
(Joins sheet 29)
R. 17 E.
N
(Joins sheet 33)
T. 22 N.
MAYES COUNTY
ROGERS COUNTY
TURNPIKE
WILL
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
(Joins sheet 39)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(36)
(Joins sheet 31)
R. 15 E.
T. 21 N.
N
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 41)
RIVER
VERDIGRIS
Lone Elm School
South Limestone School
NaB
CmB
SuC
Rs
So
Ve
Vf
Os
RmB
SuB
RvC
Gp
ChB
DnC
BdC2
SuC2
Vd
Hc
Bc
DnB
Br
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

R. 15 E. | R. 16 E.

T. 21 N.

(Joins sheet 32)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 42)

37

N

OLD HWY 88

OKLAHOMA MILITARY ACADEMY

WILL ROGERS MEMORIAL

WILL ROGERS AIRPORT

LANTO STADIUM

CLAREMORE HEALTH CENTER

CLAREMORE

INDIAN HOSPITAL

ROGERS COUNTY FAIRGROUNDS

WOODLAWN CEMETERY

SAN FRANCISCO

MISSOURI

PACIFIC

ST LOUIS

Cat Creek

Cherry Creek

TURNPIKE

WILL ROGERS

Scale 1: 20 000

0 ½ 1 Mile

0 5000 Feet

(38)
N
(Joins sheet 33)
R. 16 E.
R. 17 E.
T. 21 N.
LAKE CLAREMORE
WILL ROGERS ROUND UP CLUB
Verdigris River
Dog Creek
TURNPIKE
ROGERS
WILL
Justus School
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 43)
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

R. 17 E.

(Joins sheet 34)

39

N

T. 21 N.

(Joins sheet 38)

MAYES COUNTY

(Joins sheet 44)

Panther Creek

Chouteau Creek

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(Joins sheet 35)

R. 14 E. | R. 15 E.

T. 21 N.

TULSA COUNTY

(Joins sheet 41)

(Joins sheet 45) | (Joins 46)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

42
(Joins sheet 37)
R. 15 E.
R. 16 E.
N
T. 21 N.
(Joins sheet 41)
(Joins sheet 43)
SAN FRANCISCO
ST. LOUIS
TURNPIKE
ROGERS
WILL
Cat Creek
Dog Creek
19
20
21
24
25
28
29
30
31
32
33
36
(Joins sheet 47)
(Joins 48)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 43

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(44)

(Joins sheet 39)

R. 17 E.

N

T. 21 N.

MAYES COUNTY

(Joins sheet 43)

(Joins sheet 49)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

R. 14 E. | R. 15 E. (Joins sheet 40)

45

N

T. 20 N.

TULSA COUNTY

(Joins sheet 46)

(Joins sheet 50)

BIRD CREEK

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(46) (Joins 40) | (Joins sheet 41)

R. 15 E.

T. 20 N.

N

(Joins sheet 45)

(Joins sheet 47)

(Joins sheet 51)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

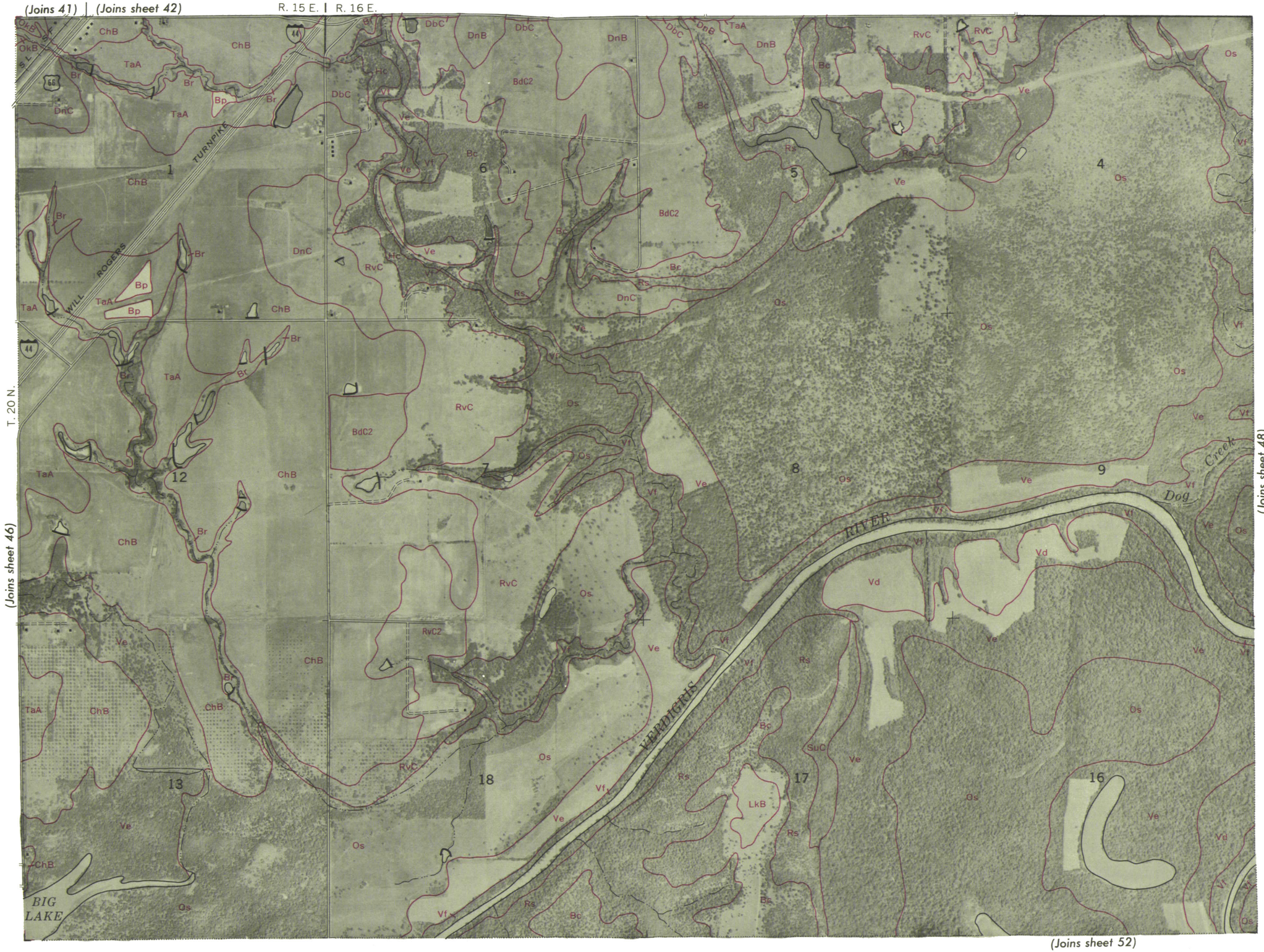
(Joins 41) | (Joins sheet 42)

R. 15 E. | R. 16 E.

47

N

T. 20 N.



(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 52)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins 43) | (Joins sheet 44)

R. 17 E.

49

N

T. 20 N.

(Joins sheet 48)

(Joins sheet 54)

MAYES COUNTY

Otter Creek

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(Joins sheet 45)

(Joins sheet 51)

R. 14 E. | R. 15 E.

T. 20 N.

N

TULSA COUNTY

WAGONER COUNTY

CEMENT PLANT

ST LOUIS SAN FRANCISCO

BIRD CREEK

TURNPIKE

ROGERS

WILL

ROLLING HILLS COUNTRY CLUB

Catoosa

22 23 24 19

27 26 25 30

34 35 36 31

Rs LkC Vd

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(52)

(Joins sheet 47)

R. 15 E. | R. 16 E.

N

T. 20 N.

(Joins sheet 51)

(Joins sheet 53)

VERDIGRIS RIVER

Fin and Feather Lake

FIN AND FEATHER CLUB

19 20 21 24 25 29 30 28 31 32 33 36

Os Ve Vf Rs Bc Vd Hc DbC OkB BdC2 DnB Br ChB SuC HlC LkC DnC Er RvC TaA PaA Bp

WAGONER COUNTY

(Joins inset, sheet 57)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

ROGERS COUNTY, OKLAHOMA — SHEET NUMBER 53

R. 16 E. | R. 17 E.

(53)

N

T. 20 N.

(Joins sheet 48)

(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 55)

Gregory School

MISSOURI PACIFIC

Coal Creek

Commodore Creek

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(Joins sheet 49)

R. 17 E.

54

N

T. 20 N.

MAYES COUNTY

(Joins sheet 53)

(Joins sheet 56)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

R. 16 E. | R. 17 E.

T. 19 N.

(Joins sheet 53)

(Joins inset, sheet 57)

(Joins sheet 56)

(Joins sheet 57)

55

N

VERDIGRIS RIVER

WAGONER COUNTY

Commodore Creek

Scale 1: 20 000

0 ½ 1 Mile

0 5000 Feet

56

(Joins sheet 54)

R. 17 E.

N

Inola

Creek

MISSOURI PACIFIC

Bird

Creek

T. 19 N.

MAYES COUNTY

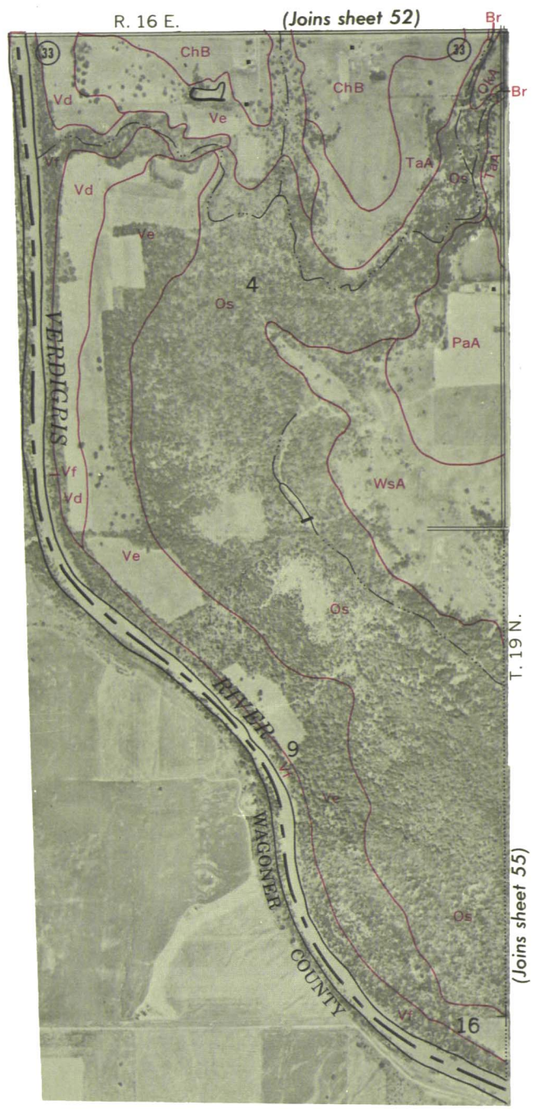
(Joins sheet 55)

(Joins sheet 58)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



WAGONER COUNTY

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

57

58
(Joins sheet 56)
R. 17 E.
N
T. 19 N.
(Joins sheet 57)
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
Pea Creek
MISSOURI PACIFIC
Bull Creek
MAYES COUNTY
WAGONER COUNTY
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet